ENDO2022 • JUNE 11 – 14, 2022 • ATLANTA, GEORGIA

FEBRUARY 2022

THE LEADING MAGAZINE FOR ENDOCRINOLOGISTS

Endocrine news

INTERNATIONAL

MEASURE *for* MEASURE

Advances in Pediatric Growth Hormone Research

- **GROWTH SPURT:** How pegvisomant could be a solution to the phenomenon of X-linked acrogigantism.
- **LEVELING UP:** New research shows promising results for the future of treating pediatric growth hormone deficiency.
- **SEX, RACE, AND MEASURING TAPE:** Health disparities and growth hormone deficiency

TRANSGENDER HEALTH:
New study sheds light on diabetes risk in transgender women.

ENDOCRINE SOCIETY
Hormone Science to Health

Endocrine news

THE LEADING MAGAZINE FOR ENDOCRINOLOGISTS

IN THIS ISSUE

FEBRUARY 2022

www.endocrine.org

Follow us on Twitter: @Endocrine_News

ENDOCRINE SOCIETY
Hormone Science to Health

THE ENDOCRINE SOCIETY IS
THRILLED TO ANNOUNCE AND CONGRATULATE THE

2022 LAUREATE AWARDS WINNERS

FRED CONRAD KOCH LIFETIME ACHIEVEMENT AWARD
Henry M. Kronenberg, MD

GERALD D. AURBACH AWARD FOR OUTSTANDING TRANSLATIONAL RESEARCH
Terry J. Smith, MD

INTERNATIONAL EXCELLENCE IN ENDOCRINOLOGY AWARD
Lourdes Ibáñez, MD, PhD

OUTSTANDING CLINICAL INVESTIGATOR AWARD
Karel Pacak, MD, PhD, DSc

VIGERSKY OUTSTANDING CLINICAL PRACTITIONER AWARD
David W. Harris MD

OUTSTANDING EDUCATOR AWARD
Kathryn A. Martin, MD

OUTSTANDING LEADERSHIP IN ENDOCRINOLOGY AWARD
John A. H. Wass, MD, MA, FRCP

OUTSTANDING MENTOR AWARD
Jane E.B. Reusch, MD

OUTSTANDING PUBLIC SERVICE AWARD
Rita Rastogi Kalyani, MD, MHS

OUTSTANDING SCHOLARLY PHYSICIAN AWARD
Ken K.Y. Ho, MD, FRACP, FRCP, FAHMS

RICHARD E. WEITZMAN OUTSTANDING EARLY CAREER INVESTIGATOR AWARD
Shingo Kajimura, PhD

ROY O. GREEP AWARD FOR OUTSTANDING RESEARCH
Michael W. Schwartz, MD

SIDNEY H. INGBAR AWARD FOR DISTINGUISHED SERVICE
Simon J. Rhodes, PhD

AWARDS WILL BE PRESENTED AT ENDO 2022:
THE ANNUAL MEETING & EXPO IN ATLANTA, GA, JUNE 11-14, 2022.

ENDOCRINE SOCIETY
Hormone Science to Health

Renewing Our Commitment to Patient Engagement

We are redoubling our efforts to reach underserved communities by revitalizing our patient engagement initiative. Through our clinical work and research, we are well aware that health disparities have a significant impact on individuals with diabetes and other endocrine conditions. As a community, we are determined to do all we can to break down those barriers and improve access to care.

> "Through our clinical work and research, we are well aware that health disparities have a significant impact on individuals with diabetes and other endocrine conditions."

Moving forward, we plan to hold up to four in-person EndoCares® patient outreach days in various cities each year, twice as many events as in the past. EndoCares® has hosted in-person health education events for thousands of people in underserved communities since 2016, and we look forward to reaching even more through our expanded program. Our focus will be on advancing diversity, equity, and inclusion by hosting events for underserved communities.

We will bring our experts directly to diverse communities, beginning in Atlanta, Ga., in June, in conjunction with **ENDO 2022**. We hope to facilitate access to the care that the residents need on an ongoing basis. We also plan to host events in Baltimore, San Francisco, and Seattle. We are looking for local volunteers to support these events. Please reach out to us, and fill out our volunteer form if you'd like to participate.

For more than two decades, we have worked to help patients, their families, and the public understand the endocrine system and its impact on their health. I am grateful to our many volunteers who served on the Patient Engagement Committee and its forerunners. Your ideas helped us create a robust digital presence filled with trusted health resources and our EndoCares® program.

We are now building on that strong foundation and expanding our patient engagement work. We have unified our digital materials, including our Endocrine Library, under our primary brand. This will bolster our reputation as trusted sources of public health information and showcase the role you, our valued members, play in developing evidence-based materials for consumers.

You will be able to find educational materials to share with your patients on our new digital hub, **https://www.endocrine.org/patient-engagement**. This hub houses our Endocrine Library and other resources. It is also the home of our revamped Menopause Map, which launched last month. We will be moving our video vault and clinical trial recruitment resources here in the coming months.

I am grateful to our Patient Engagement Committee members — led by Christine M. Burt Solorzano, MD — for their roles overseeing this transition. Many thanks to J. Sonya Haw, MD, and Priyathama Vellanki, MD, who will serve as local hosts for our debut event in Atlanta.

It is so satisfying to be able to use our scientific and medical expertise to give back and advance public health. These programs can help us make a real difference and improve the lives of individuals with endocrine conditions and their families. I hope you will join me in volunteering time and expertise to make our expanded patient outreach efforts successful. I welcome your comments and suggestions on how we can continue to strengthen our engagement with our patients. EN

Carol H. Wysham, MD
President, Endocrine Society

Focusing on Pediatric Growth Hormone Research

This month's issue takes an entirely new focus as we take a look at the advances being made in pediatric growth hormone research as our team looks at some recently published studies.

On page 20, Kelly Horvath looks at how a pharmaceutical is showing promise for patients diagnosed with X-linked acrogigantism in "Growth Spurt: How Pegvisomant Could Be a Promising Solution to a Big Problem." These pediatric patients tend to resist conventional pituitary tumor treatments. However, recently published data appears to suggest that pegvisomant could not only be an ideal treatment option, but it could also improve the patients' quality of life, which often includes a number of issues associated with any pituitary tumor, including headaches or hypothalamic or partial or complete pituitary deficiencies, according to Constantine A. Stratakis, MD, D(med)Sci, PhD(hc), chief scientific officer, ELPEN, Athens; director (Res. A'), Human Genetics & Precision Medicine, Foundation for Research and Technology — Hellas (FORTH), Heraklion, Crete, Greece, but who undertook this research while at the National Institutes of Health.

"All of these things affect [quality of life]," Stratakis tells Horvath. "They are common among the various patients with pituitary tumors who have had surgery or other modes of treatment that affect the function or the anatomy of the pituitary gland or the hypothalamus." He adds that there are certain issues specific to gigantism, which is a unique disease, such as a four-year-old child the size of a seven-year-old. "This completely changes the dynamics of these kids and their relationships with their peers and their position in the family. In the eyes of other kids or family members, we have an incongruity between behavior and size, similar to but the inverse of patients with extreme short stature."

In speaking with Stratakis, Horvath found out that the reason he became interested in endocrinology in the first place stemmed from a familial diagnosis from his childhood; when his brother was nine years old, he was diagnosed with craniopharyngioma, one of the most common pediatric brain tumors. This set the path for the rest of Stratakis's life and career; by the time he was in high school — after a childhood spent

FEBRUARY 2022

Endocrine news

THE LEADING MAGAZINE FOR ENDOCRINOLOGISTS

Editor: **Mark A. Newman**
mnewman@endocrine.org

Senior Editor: **Derek Bagley**
dbagley@endocrine.org

Art Director/Production: **Anthony S. Picco**

Art Director/Design: **Catherine C. Neill, CNJ Creative, saLLC**
www.cnjcreative.com

Prepress & Printing: **The Sheridan Group**
www.sheridan.com

Endocrine News is a registered trademark owned by the Endocrine Society.

Endocrine News informs and engages the global endocrine community by delivering timely, accurate, and trusted content covering the practice, research, and profession of endocrinology.

Endocrine News® is published 12 times a year by the Endocrine Society, 2055 L Street, NW, Suite 600, Washington, DC 20036
Phone 202-971-3636 • Fax 202-736-9708
www.endocrine.org.

Print ISSN 2157-2089 Online ISSN 2157-2097

- Please send letters to the editor, comments, and suggestions for Endocrine News® to *mnewman@endocrine.org.*
- Product print and product online display advertising, by Pharmaceutical Media, Inc., contact Joe Schuldner, *jschuldner@pminy.com*, or John Alberto, *jalberto@pminy.com.*
- For classified print advertising by Pharmaceutical Media, Inc., Dan Simone, *dsimone@pminy.com*
- For classified online advertising by *endocareers@endocrine.org*

looking at everything under a microscope he was given as a teenager — he knew he wanted to be an endocrinologist. "I served so many patients, including many with the disease that my brother had," he says. "One can never fully pay back the fortune we had as a family to have my brother a healthy and productive member of our society, but part of my legacy will be that I tried to do it." (By the way, Stratakis tells more of his story in "His Brother's Keeper," a sidebar that accompanies Horvath's feature.)

On page 14, senior editor Derek Bagley delves into how advances in a growth hormone deficiency treatment are starting to show promise in "Leveling Up." The article centers around scientists in their quest for a treatment that does not have to be administered every day. In the article, Bagley speaks to two authors of a paper published in the October 2021 *Journal of the Endocrine Society* detailing a trial that found that the investigational long-acting, once-weekly prodrug lonapegsomatropin may be more beneficial to treatment-naïve pediatric patients with growth hormone deficiency than daily somatropin of equivalent weekly dose. As some of these new treatments are yet to be approved by the U.S. Food and Drug Administration, the researchers remain hopeful that their formula for collecting and interpreting IGF-1 levels in patients on long-term lonapegsomatropin therapy will help clinicians in the future.

In "Sex, Race, and Measuring Tape: Health Disparities and Growth Hormone Deficiency" (p. 30), Eric Seaborg looks at the phenomenon of racial and gender disparities among children who could benefit from growth hormone treatment. He looks at new research that seems to indicate that white children — especially boys — are offered growth hormone stimulation tests at a significantly higher rate than girls or Black and Hispanic children. Seaborg writes that the authors of one of the studies lament that the evaluation and treatment of children with short stature should be determined by clinical concerns alone, adding, "but this is not current practice."

As usual, if you have any comments on any of this month's articles, or ideas for upcoming articles, feel free to let me know at **mnewman@endocrine.org**. Many of our best stories are based on suggestions submitted by many of you! EN

— Mark A. Newman, Editor, *Endocrine News*

Endocrine Society Launches Reinvigorated Patient Outreach Program

To reach larger audiences of individuals with endocrine conditions, particularly those in underserved communities, the Endocrine Society is expanding its in-person health education events and launching a new consumer health education web presence.

> **With the support of the Endocrine Society, we look forward to being able to provide access to medical experts and screenings to our local community here.**

Moving forward, the Society's public health education will concentrate on diversity, equity, and inclusion. Programming and resources will be designed specifically to benefit minorities and underserved communities.

"We are dedicated to giving back and helping to build health equity in underserved communities," says Society President Carol H. Wysham, MD. "Our EndoCares' events and health education resources help address health disparities and improve access to care for common endocrine conditions, including diabetes, metabolic syndrome and obesity, thyroid disorders, and osteoporosis."

The new online content hub, which debuts today, includes a redesigned version of the Menopause Map™, an interactive tool to help women learn about menopause and start important conversations with their healthcare providers and peers.

Since 1998, the Endocrine Society has offered patient and consumer health education materials about the body's hormones and related conditions through its patient education arm, most recently known as the Hormone Health Network (HHN). Patient outreach is being moved under the Endocrine Society brand to emphasize that the world's largest professional organization of more than 18,000 endocrine clinicians and researchers develops these trusted materials.

The Society's reorganized patient engagement program also will incorporate EndoCares®, a series of in-person health education events the Society has hosted since 2016. The events focus on bringing endocrine experts directly to underserved and underrepresented communities to improve health care access.

"We are thrilled to be expanding our successful EndoCares® program to reach even more people with endocrine conditions and their caregivers," said Christine M. Burt Solorzano, MD, Chair of the Society's Patient Engagement Committee. "With twice as many events each year, we'll be able to deliver valued health advice and screenings to new audiences in underserved communities."

The Society plans to hold four EndoCares® events in U.S. cities this year — twice the number it has held previously. The flagship event will take place in Atlanta in conjunction with the Society's annual meeting, **ENDO 2022**, in June. San Francisco, Baltimore, and Seattle also will host EndoCares® events.

"With the support of the Endocrine Society, we look forward to being able to provide access to medical experts and screenings to our local community here in Atlanta," says local EndoCares® host Priyathama Vellanki, MD, who is co-hosting the event with J. Sonya Haw, MD. "Our event, planned for June 2022, will fill an unmet need and make it easy for individuals with diabetes and other endocrine conditions to access needed resources."

Endocrine Society Joins Groups to Petition FDA on BPA in Food Packaging

The Endocrine Society joined a coalition of physicians, scientists, and public health and environmental organizations to send a formal petition to the Food and Drug Administration (FDA), calling on the agency to rescind its approvals for bisphenol A (BPA) in adhesives and coatings, and set strict limits on its use in plastics that contact food.

New findings from a panel of experts convened by the European Food Safety Authority (EFSA) indicate that the harmful effects from BPA exposure can occur at levels 100,000 times lower than previously thought. This new safe level — based on recent scientific evidence — is more than 5,000 times below what the FDA says most Americans are safely exposed to.

Without a doubt, these values constitute a high health risk and support the conclusion that uses of BPA are not safe. The petition calls on the FDA to limit uses of BPA in food contact articles that may result in migration into food above 0.5 nanograms per kilogram of food.

The petition was filed by Environmental Defense Fund, the Endocrine Society, Breast Cancer Prevention Partners, Clean Water Action/Clean Water Fund, Consumer Reports, Environmental Working Group, Healthy Babies Bright Futures, Dr. Maricel Maffini, and Dr. Linda Birnbaum, former director of the National Institute of Environmental Health Sciences and National Toxicology Program.

BPA is used to make polycarbonate and other plastics, which are commonly used in hard items such as food containers, pitchers, tableware, storage containers, and more. The chemical is also used in epoxy resins that line the inside of metal products and bottle tops. Small amounts of BPA can migrate from containers or equipment into food and beverages.

Industry has taken steps in the past to limit the use of BPA in can linings and plastic baby bottles. These actions followed 2008 findings from the Centers for Disease Control and Prevention indicating the chemical showed up in 92% of US adults and additional studies that showed BPA can act like the female sex hormone, estrogen, in humans and disrupt normal development.

Findings from EFSA's expert panel show that BPA's effects are much worse than previously understood and that people are exposed at levels dramatically above what is safe. Extremely low exposures to BPA can lead to an overactive immune system producing out-of-control inflammation, as well as changes in the ovaries, endocrine disruption, and reduced learning and memory, according to the EFSA panel.

The FDA has long collaborated with EFSA on risk assessment and risk communication related to food safety, including working together to increase understanding of risks from chemicals used in food packaging, like PFAS. The agency now needs to listen to the warnings on BPA from its expert counterparts at EFSA and take steps to dramatically reduce our exposures to the chemical.

"These findings are extremely concerning and prove the point that even very low levels of BPA exposure can be harmful and lead to issues with reproductive health, breast cancer risk, behavior and metabolism," says Endocrine Society BPA expert Heather Patisaul, PhD, of North Carolina University in Raleigh, N.C. "The FDA needs to acknowledge the science behind endocrine-disrupting chemicals and act accordingly to protect public health."

BY DEREK BAGLEY
Senior Editor

Abnormal Thyroid Hormone Levels During Pregnancy May Increase the Risk of Preschool Boys' Behavioral Problems

Expecting mothers' thyroid hormone levels may predict how their preschool boys develop emotionally and behaviorally, according to a study recently published in *The Journal of Clinical Endocrinology & Metabolism*.

Researchers led by Kun Huang, PhD, of the Anhui Medical University in Anhui, China, point out that while studies have shown thyroid hormone levels during pregnancy have been associated with adverse maternal and child outcomes, such as low birth weight, most of these studies have only looked at thyroid hormone levels during a single trimester; there is limited data on repeated measurements of these levels during pregnancy. "However, maternal thyroid hormones are dynamic during pregnancy," the authors write. "Thyroid hormone trajectories may be a better predictor of children's behavioral problems than assessment of thyroid function during a single trimester."

For this study, the researchers studied 1,860 pairs of mothers and their children from the Ma'anshan Birth Cohort in China, repeatedly measuring TSH, FT4, and thyroid peroxidase antibody (TPOAb) in the first, second, and third trimesters of pregnancy, aiming to understand the sex-specific impact of maternal TSH and FT4 trajectories on preschoolers' behavioral development. The researchers checked in with the families periodically until the children were four years old to evaluate their behavior.

The researchers found boys born to mothers with high thyroid hormone levels during pregnancy were more likely to be withdrawn, have behavioral problems, and be anxious or depressed. Moderate and low thyroid hormone levels were associated with aggressive behavior in preschool boys.

"The researchers found boys born to mothers with high thyroid hormone levels during pregnancy were more likely to be withdrawn, have behavioral problems, and be anxious or depressed."

The authors of the paper are careful to mention that these findings are only in boys, and that the potential mechanism is unclear. They write that studies have shown that the interaction between thyroid hormones and sex steroid hormones is more direct in males, and that they suspect that boys may be more susceptible to alterations of maternal thyroid hormones and thus further to the subsequent behavioral problems. There also may be other factors that affect behavior that can't be ruled out, such as parents' marital status, family environment, and maternal EDC exposure.

Still, based on the design of the study and the subsequent results, the authors conclude that maternal thyroid hormone trajectories impact preschool boys' behavioral development.

Strategic Partnership Will Bring Digital Health Innovation to the Hospital Bedside

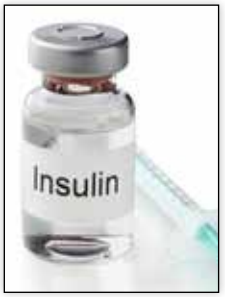
Glytec and Roche Diagnostics USA last month announced a digital health collaboration that combines Roche's expertise in medical devices and IT solutions with Glytec's FDA-cleared insulin dosing decision support software, Glucommander™, to address the pervasive challenges with inpatient blood sugar management at the hospital bedside. Glucommander will be the first software application available to run on Roche's smart-device next-generation hospital blood glucose system, cobas® pulse, which is designed with the intention of improving patient safety and care by empowering point-of-care clinicians to collect and take immediate action on glycemic management data.

Glucommander has been proven to reduce severe low blood sugar by 99.8%, 30-day readmissions by 36% – 68%, and length of stay by up to 3.2 days. The safety and efficacy of Glucommander have been validated in hundreds of research studies.

This combination of hardware and software is designed to help nurses and physicians close the gap between getting data and taking action. Clinicians' time is their most limited resource: The objectives of the partnership are to combine the immediacy of a bedside blood glucose test with Glytec's insulin decision support on a single, handheld device with the intention of streamlining workflows and saving time. The integrated device and applications are designed to improve patient safety and outcomes by empowering point-of-care clinicians to collect and take immediate action on glycemic management data.

"From the temporary allowance of CGM usage inside health systems to the recent CMS eCQMs around severe hypoglycemia and severe hyperglycemia, there has been a groundswell of focus on inpatient glycemic management across the healthcare industry," says Jordan Messler, MD, SFHM, FACP, chief medical officer at Glytec. "Our partnership with Roche is exciting because it showcases two industry leaders working closely together to embrace this heightened focus and address the significant challenges hospitals face with inpatient blood sugar management."

"Combining Glytec's proven insulin dosing support software, Glucommander, with Roche's next generation handheld blood glucose system allows us to design an end-to-end solution that will empower clinicians to take immediate action on real-time glycemic data, saving time and streamlining workflows. Glucommander's approach to personalized insulin dosing has been shown to improve patient safety and reduce time to target blood glucose range — this collaboration will add even more benefits that improve patient outcomes," Messler adds.



"From the temporary allowance of CGM usage inside health systems to the recent CMS eCQMs around severe hypoglycemia and severe hyperglycemia, there has been a groundswell of focus on inpatient glycemic management across the healthcare industry."

Newly Identified Hormone May Be Critical Driver of Type 1 and Type 2 Diabetes

A newly discovered hormone named fabkin helps regulate metabolism and may play an important role in the development of both type 1 and type 2 diabetes, according to research led by the Sabri Ülker Center for Metabolic Research at Harvard T.H. Chan School of Public Health. The findings were published in *Nature*.

The study showed blood levels of fabkin were abnormally high in mice and human patients with either type 1 or type 2 diabetes. Researchers led by Gokhan S. Hotamisligil, MD, PhD, director of the Sabri Ülker Center, found that blocking the activity of fabkin prevented the development of both forms of diabetes in the animals. Fabkin likely plays a similar role in humans, and the hormone complex could be a promising therapeutic target, according to the researchers.

Fabkin is different from traditional hormones in that it is not a single molecule with a single defined receptor. Instead, fabkin is composed of a functional protein complex consisting of multiple proteins, including fatty acid binding protein 4 (FABP4), adenosine kinase (ADK), and nucleoside diphosphate kinase (NDPK). Through a series of experiments, the researchers determined that fabkin regulates energy signals outside of cells. These signals then act through a family of receptors to control target cell function. In the case of diabetes, fabkin controls the function of beta cells in the pancreas that are responsible for insulin production.

More than a decade ago, Hotamisligil and colleagues discovered that a protein known as FABP4 is secreted from fat cells during lipolysis, the process in which lipids stored within fat cells are broken down, typically in response to starvation. Numerous studies have since shown correlations between circulating FABP4 and metabolic diseases including obesity, diabetes, cardiovascular disease, and cancer. However, the mechanism of action was unknown.

In the new study, the researchers showed that when FABP4 is secreted from fat cells and enters the blood stream, it binds with the enzymes NDPK and ADK to form the protein complex now identified as fabkin. In this protein complex, FABP4 modifies the activity of NDPK and ADK to regulate levels of molecules known as ATP and ADP, which are the essential units of energy in biology. The researchers discovered that surface receptors on nearby cells sense the changing ratio of ATP to ADP, triggering the cells to respond to the changing energy status. As such, fabkin is able to regulate the function of these target cells.

The authors showed that the insulin-producing beta cells of the pancreas are a target of fabkin and that the hormone is a driving force behind the development of diabetes. When the researchers used an antibody to neutralize fabkin in mice, the animals did not develop diabetes. When the antibody was given to obese, diabetic mice, they reverted to a healthy state.

“The authors showed that the insulin-producing beta cells of the pancreas are a target of fabkin and that the hormone is a driving force behind the development of diabetes. When the researchers used an antibody to neutralize fabkin in mice, the animals did not develop diabetes.”

Review Explores Latest in Hormone Therapy in Menopause

A paper recently published in *Endocrine Reviews* looks to provide readers with an improved understanding in approaches to using hormone therapy (HT) to treat menopausal women.

The review, by Valerie Flores, MD, and Lubna Pal, MD, of Yale School of Medicine and JoAnn Manson, MD, of Harvard Medical School, points out that hormone therapy remains the best and most effective treatment option for treating menopausal vasomotor symptoms (VMS) and the genitourinary syndrome of menopause (GSM). Hormone therapy has also been shown to reduce the risk of fracture and type 2 diabetes.

However, hormone therapy does carry some risks, especially in women with advanced age or comorbidities or other risk factors for stroke and venous thromboembolism. Especially in women who experience early or premature menopause (and are thus at increased risk of osteoporosis and coronary heart disease [CHD]), the authors write that initiation of hormone therapy should be prioritized, "even in the absence of bothersome symptoms given that in the absence of intervention, this patient population is at an elevated lifetime risk for a number of chronic disorders that can be mitigated with timely initiation of hormone replacement."

The authors write about the "timing hypothesis" — that the timing of HT initiation in relation to time since the final menstrual period. The authors write that analyses of the Women's Health Initiative (WHI) hormone therapy trials show that the more proximate the time of the initiation of hormone therapy, the more likely it is that hormone therapy will be more protective of organ tissues. On the other hand, older menopausal women who are more than 10 years out from their final menstrual period, are at higher risk for hormone therapy-related adverse outcomes. In women who were more than 20 years from the time of menopause, use of HT was associated with a significantly increased risk of CHD. "[S]ubsequent metanalyses have also demonstrated reduced risk of CHD in women initiating [hormone therapy] within 10 years of menopause onset."

The review covers a lot and looks to a better understanding of the timing hypothesis, the role of transdermal vs. oral HT, and novel treatments

for menopause symptoms, such as more precise nonhormonal therapies. The review also notes that hormone therapy prescriptions remain low, which could reflect a lingering concern on the part of clinicians as well as ongoing hesitation on the part of menopausal women regarding the safety of hormone therapy.

This review also shows the continued importance of tailored care for each woman. "While it is important to understand potential risks associated with [hormone therapy], it is equally important to recognize the benefits of treatment," the authors write. "For the vast majority of symptomatic women, the benefits of HT outweigh the risks. It is imperative that the choice of treatment be individualized and that patients share in the decision making." EN

"For the vast majority of symptomatic women, the benefits of HT outweigh the risks. It is imperative that the choice of treatment be individualized and that patients share in the decision making."

ENDO 2022

June 11 – 14, 2022 • Atlanta, Georgia/Virtual Event

ADVANCE REGISTRATION:

Early Bird: January 12, 2022 – March 4, 2022
Advanced: March 5, 2022 – May 18, 2022
Late/On Site: May 19, 2022 – June 14, 2022

HOUSING DEADLINE: May 20, 2022

ENDO 2022, taking place June 11 – 14, will be the Society's inaugural hybrid meeting; attendees can participate in Atlanta, online ... or both! This increased flexibility will foster expanded connectivity, community, and knowledge-sharing among the diverse, international endocrine community. Each format has intrinsic benefits, and when the time comes, attendees will have the option to select the best format that suits their desires and needs when June 2022 rolls around.

Attendees can expect top-flight education at **ENDO 2022**, as well as a new vibrancy and contemporary conference experience with expanded networking. Learners can expect a range of carefully curated sessions in a variety of delivery formats spanning the endocrinology journey from bench to bedside and back again. **ENDO 2022** attendees will have the opportunity to tailor their learning experience to fit their precise professional and personal development needs. The Society is also ramping up its investment in technology-forward learning enhancements to align the **ENDO** learning experience with the reality of day-to-day life in the 21st century. **www.endocrine.org/endo2022**

Clinical Endocrinology 2022

Live Streaming
April 6 – 10, 2022

Clinical Endocrinology 2022, a live streaming CME program, has been optimized for remote learning. All sessions and workshops will be live streamed and include online, live chat, where participants can pose their specific questions to faculty. All sessions and workshops will be recorded and made available to participants for online viewing, at their convenience, via a course archive. As a participant, you will be able to access these recordings for 60 days after the conclusion of this course. For nearly 50 years, renowned experts in endocrinology at Harvard Medical School and Massachusetts General Hospital have delivered the CME course Clinical Endocrinology — the acclaimed annual update of current endocrine diagnostic and management strategies. If you provide care to patients with endocrine disorders, this course will be invaluable to your medical decision making and patient care.
https://endocrinology.hmscme.com

2022 ACOG Annual Clinical & Scientific Meeting

San Diego, California
May 6 – 8, 2022

The American College of Obstetrics and Gynecologists Annual Clinical Scientific Meeting (ACSM) has long been a gathering of the leading women's healthcare experts, and this year is no exception. ACSM provides attendees with cutting-edge research, clinical best practices, and collaborative solutions to the challenges faced by our members. Sessions for the meeting will center around four tracks: obstetrics, gynecology, professional development, and office practice. Concise and focused sessions across a variety of topics promise to engage attendees while providing opportunities to connect. The programming for ACSM 2022 will emphasize this year's theme: Reconnect, Recharge, Reset.
https://www.acog.org/

The Growth Hormone (GH)/ Prolactin (PRL) Family in Biology & Disease Conference

Athens, Ohio
May 15 – 19, 2022

The aim of this FASEB Science Research Conference (SRC) is to improve our understanding of the regulation and action of growth

hormone (GH) and prolactin (PRL) and their specific receptors. The conference will present and integrate novel research advances in GH/PRL biology to raise the profile of the field and foster new national and international collaborative projects. A key aspect is to encourage and support emerging investigators/trainees and the participation of underrepresented groups.
https://www.faseb.org/

AAES 2022

Cleveland, Ohio and Virtual Event
May 22 – 24, 2022

As the leading endocrine surgery association in North America, the American Association of Endocrine Surgeons (AAES) Annual Meeting is the premier event to connect with professionals and leaders across the globe in the field of endocrine surgery while receiving high-level education on the latest advancements in science and research. The 2022 Annual Meeting will be a hybrid event taking place in Cleveland, Ohio, but with virtual opportunities. While in-person podium presentations are preferred, exceptions will be made, and the ability to travel to the meeting venue is not a prerequisite for abstract acceptance.
https://www.endocrinesurgery.org/2022-annual-meeting

American Diabetes Association's 82nd Scientific Sessions

Hybrid – New Orleans, Louisiana
June 3 – 7, 2022

We know many of you are eager to get back to participating in-person, networking with colleagues, hearing the latest scientific advances and groundbreaking research presentations, and experiencing the exhibit and poster halls. We encourage everyone to join us June 3 – 7, 2022, at the Ernest N. Morial Convention Center in New Orleans, La. The health and safety of our attendees remain our top priority, and we will follow COVID-19 safety practices. For those unable to join us in-person, we are planning a virtual program to ensure as many people as possible can participate.
https://professional.diabetes.org/scientific-sessions

INTERNATIONAL **ITINERARY**

ATTD 2022

Paris, France
March 8 – 11, 2022

Join us in Paris for the 15th International Conference on Advanced Technologies & Treatments for Diabetes. For 15 years, ATTD has stood at the forefront of diabetes innovation. Remarkable developments keep coming at full speed, and ATTD 2022 will again be the platform to present, review, and discuss the latest changes. We aim to move the diabetes field forward with an ever-growing community that promotes and enhances novel technologies and treatments to change the lives of people with diabetes.
https://attd.kenes.com/

WCO-IOF-ESCEO 2022

Berlin, Germany
March 24 – 27, 2022

For this 22nd edition of the World Congress on Osteoporosis, Osteoarthritis, and Musculoskeletal Diseases (WCO-IOF-ESCEO) Congress, the members of the Committee of Scientific Advisors of the IOF and the members of the Scientific Advisory Board of ESCEO are developing a very exciting Congress' scientific program that will bring together the world's best in the field of musculoskeletal health and disease.
https://www.wco-iof-esceo.org

3rd World Congress on Diabetes & Endocrinology

Dubai, UAE
May 9 – 10, 2022

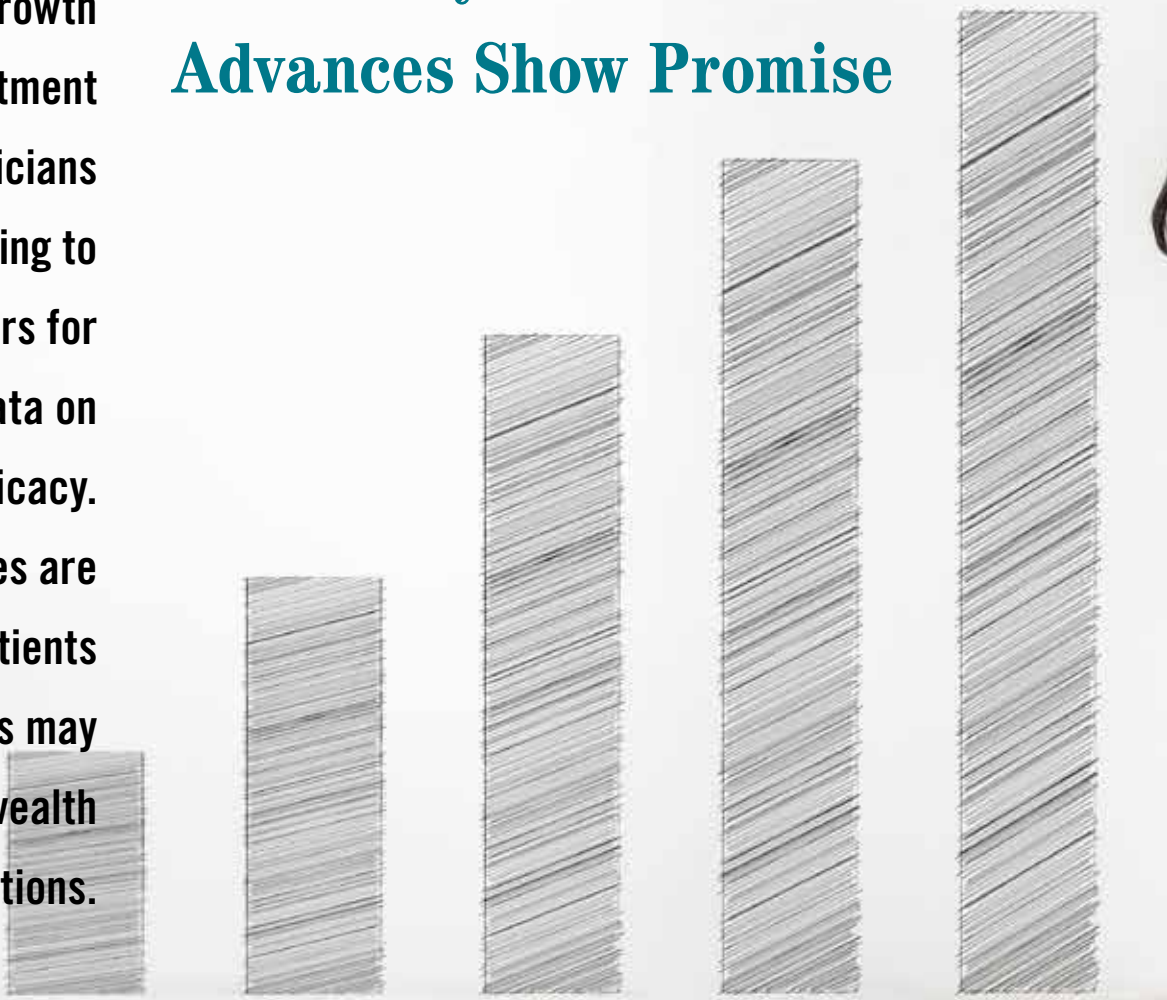
The 3rd World Diabetes Congress 2022 brings together a unique international mix of experts, researchers, and decision makers both from academia and industry across the globe to exchange their knowledge, experience, and research innovations. This conference is a unique international platform that's a confluence of all stakeholders of the ecosystem — industry, academia, research, innovators, regulators — coming together to present and discuss current topics in diabetes and endocrinology, gestational diabetes, epidemiology and public health, obesity, pediatric endocrinology, diabetes and immunology, diabetic neuropathy, and many more. Join us to network with your peers, exchange expertise and experiences, and arm yourself with the latest information to take your department to the next level.
https://diabetes.inovineconferences.com/

BY DEREK BAGLEY

Leveling UP

Pediatric Growth Hormone Deficiency Treatment Advances Show Promise

As the desire for a less frequently administered growth hormone treatment intensifies, clinicians are looking to researchers for the latest data on safety and efficacy. As more studies are undertaken, patients and clinicians may soon have a wealth of options.



Since 1985, children with growth hormone deficiency (GHD) have been prescribed somatropin — recombinant human growth hormone (rhGHG) — to hopefully grow tall enough to be able to stand shoulder to shoulder with their peers. But this medication requires daily injections, which patients find painful, and their caregivers find burdensome, leading to noncompliance rates from 5% to a whopping 82%.

In 2015, the Growth Hormone Research Society recognized the need for long-acting growth hormone (LAGH) therapies, as decreasing the frequency of injections could lead to adherence and better outcomes. And pharmaceutical companies have responded.

This past October, a paper appeared in *The Journal of Clinical Endocrinology & Metabolism* reporting on the results of the Phase 3 heiGHt trial that found that the investigational long-acting, once-weekly prodrug lonapegsomatropin (TransCon hGH) may be more beneficial to treatment-naïve pediatric patients with growth hormone deficiency than daily somatropin of equivalent weekly dose.

The authors of that paper wrote in the conclusion that the fundamental challenge of developing a LAGH is to create a more convenient dosing regimen while retaining the excellent safety, efficacy, and tolerability of daily somatropin. "Building on the concept of releasing unmodified somatropin to maintain physiologic distribution, weekly lonapegsomatropin is the first LAGH with data demonstrating superior efficacy compared to a daily somatropin," they write. "Lonapegsomatropin may represent an important therapeutic option for children with GHD."

According to a recent report from the data and analytics company GlobalData, long-acting growth hormones — Novo Nordisk's Sogroya (somapacitan-beco), Ascendis Pharma's Skytrofa (TransCon hGH, lonapegsomatropin) Pfizer and OPKO Biologics' NGENLA (somatrogon), and Hanmi Pharmaceuticals' efpegsomatropin — are projected to capture more than 90% of the market share in the U.S., Germany, and Japan by 2030. GlobalData predicts TransCon hGH will emerge as the market leader, accounting for approximately 47% of all LAGH sales due to the fact that it releases unmodified GH and has been proven efficacious.

Daily injections, which patients find painful and their caregivers find burdensome, lead to noncompliance rates from 5% to a whopping 82%.

> “But it’s a new year, and payers may be re-evaluating what they’re covering, and there seems to be an appetite for once-weekly injections over daily jabs. Patients and physicians aren’t likely to try to put the genie back in the bottle once they start on [long-acting growth hormone therapies]. **And whatever happens with this market, the first therapy on the scene is likely the one to shape it.”**

If that’s the case, then it’s imperative these innovative therapies are not only efficacious but safe for the children and adolescents taking them. The *Journal of the Endocrine Society* recently published a sort of companion piece or follow-up to the JCEM article on lonapegsomatropin/TransCon hGH, providing clinicians with a simplified way to interpret levels of insulin-like growth factor 1 (IGF-1) in pediatric patients taking the prodrug, since the goal is to balance the growth hormone/IGF-1 interaction.

Matching Real-World Data

The authors of the JES paper write that the pharmacokinetic (PK) and pharmacodynamic (PD) profiles of lonapegsomatropin differ from daily somatropin as well as from other LAGHs with different molecular structures and physical-chemical characteristics. Physicians typically monitor IGF-1 levels in patients taking somatropin, but the JES authors point out that given the PK profile of GH released from lonapegsomatropin, the average IGF-1 level may be a more clinically relevant measure to represent overall exposure compared with peak or trough levels and may be useful to physicians.

Alan D. Rogol, MD, PhD, professor emeritus at the University of Virginia School of Medicine, in Charlottesville, and one of the authors of the JES paper, tells *Endocrine News* that lonapegsomatropin releases growth hormone, lining up with Growth Hormone Research Society guidance that any LAGH molecule needs to act the same as growth hormone, that its tissue distribution needs to be the same, and that the IGF-1 levels need to be safe. So, the questions for this new molecule became: “What do we consider whole-body exposure?” and “How can we help people learn what the average level is?”

Rogol and his co-authors analyzed 49,896 IGF-1 sample data simulated from 105 lonapegsomatropin-treated children with GHD and developed a relatively straightforward prediction formula, showing IGF-1 samples taken once four or five days after the dose lined up with a weekly average IGF-1 at steady state. What struck the researchers was that the prediction models matched exactly what was seen in the real-world data they collected. “I think that is an absolute major point,” Rogol says. “You can do it almost any time, and the modeling from the data and the real data are essentially the same.”

Bradley S. Miller, MD, PhD,* division director of pediatric endocrinology at the University of Minnesota Masonic Children's Hospital in Minneapolis and another of the JES paper authors, says that with this formula, physicians will have a day that they can use for convenience sampling. "If it's four days after the medication is given, it's going to be your average," he says. "And if it works to have labs done on that day for the patients, then that's going to be the easiest to interpret your values. Even if they come in on day two or day seven, there will be a way to estimate what their average was, using this tool. And I'm hoping that this tool will then be, in addition to being in a paper, will be available as some other method that it'll be easier for us to use."

Parental Guidance

Lonapegsomatropin last year received FDA approval for treating pediatric patients one year and older who weigh at least 11.5 kg (25.4 lbs.) and have growth failure due to inadequate secretion of endogenous growth hormone, as well as positive opinion recommending the granting of a marketing authorization from the European Medicine Agency's Committee for Medicinal Products for Human Use (CHMP). Still, if the prodrug is to corner the market by the end of the decade, it will have to clear some hurdles. Drugs explode on the scene all the time, only to just as quickly burn out or fade away.

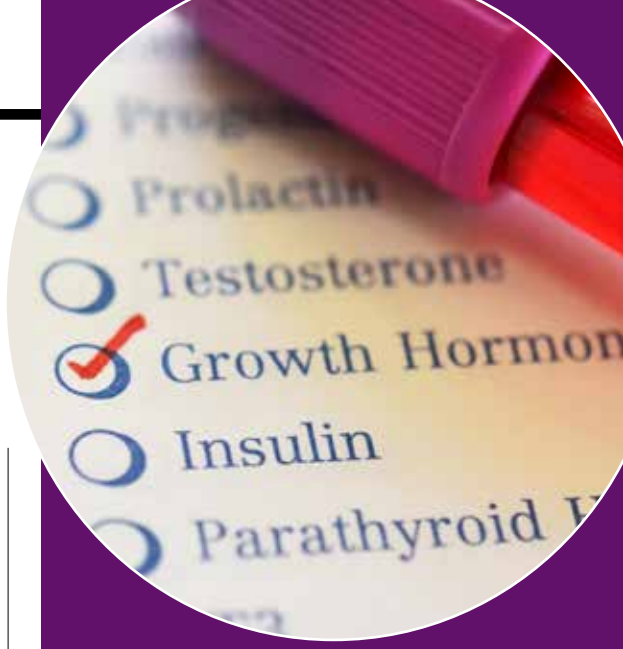
For Rogol, some physicians may be hesitant to switch to a LAGH, whether it's because of inertia or lack of knowledge, or not wanting the headache of switching products because of prior authorization. "On the other hand," he says, "parents will hear about this, and they'll be beating on our doors."

Miller says that in his experience, the most common reason patients say no to the new treatment is because they didn't want to "rock the boat" and deal with all the red tape that switching drugs can carry. "I've probably had 50% of people who I've offered it to say no, just because they didn't want to change things," he says. "They were worried that trying to switch might somehow prevent them from continuing on what they were on, or not be approved for the new drug and they'd be without anything. My early experience in offering it to kids and their families, has been, 'I don't want to upset the current thing that's working.'"

On the "LAGH Track"

But it's a new year, and payers may be re-evaluating what they're covering, and there seems to be an appetite for once-weekly injections over daily jabs. Patients and physicians aren't likely to try to put the genie back in the bottle once they start on LAGHs. And whatever happens with this market, the first therapy on the

**Miller is a consultant for Abbvie, Ascendis Pharma, BioMarin, EMD Serono, Novo Nordisk, Orchard, Pfizer, Tolmar, and Vertice and has received research support from Aeterna Zentaris, Alexion, Abbvie, Amgen, Ascendis Pharma, Lumos Pharma, Novo Nordisk, OPKO, and Pfizer.*



AT A GLANCE

- **Long-acting growth hormone therapies like lonapegsomatropin for pediatric growth hormone disorder are predicted to corner the market in the next decade, as patients and providers opt for weekly injections over daily.**
- **Researchers have developed a formula for collecting and interpreting IGF-1 levels in patients on long-term lonapegsomatropin therapy, since the drug is a different molecule than current medications.**
- **Data will be needed on the safety and efficacy of these new LAGHs as they hit the market; researchers hope this formula will provide clinicians with a streamlined way to capture that information.**

> Physicians typically monitor IGF-1 levels in patients taking somatropin, but the [*Journal of the Endocrine Society*] authors point out that given the [pharmacokinetic] profile of [growth hormone] released from lonapegsomatropin, **the average IGF-1 level may be a more clinically relevant measure to represent overall exposure compared with peak or trough levels and may be useful to physicians."**

scene is likely the one to shape it. Each one of these LAGHs is a different chemical entity, and they're going to have their own efficacy and safety data. (Some may even carry their own unique formulae for measuring IGF-1 levels.) This is all still new, so currently there aren't enough data to rightly speculate what the market will look like a decade from now. "It is, in my opinion, going to be a universe of long-acting growth hormone four or six years down the road," Rogol says. "What is the percentage of each player, that's absolutely unknown."

At the University of Minnesota, Miller and his team have an ongoing study they dubbed "UMN LAuGH Track (**https://growth.umn.edu/clinical-research-studies/laugh-track-umn**) in which they look at kids who are on daily injections versus kids who chose to switch to LAGHs as a group, determining quality of life, adherence markers, and some metabolic changes — insulin resistance, body composition changes — to see the differences in those groups. The LAGH patients are all on lonapegsomatropin. Surprisingly, however, Pfizer and OPKO's somatrogon was recently denied FDA approval, but the companies say they will continue to work with the agency to find a path forward. "I think it still is on the companies to capture that information on the long term," Miller says. "And I think each company is probably going to do that slightly differently."

Miller says he's working with Faisal Ahmed, MD, a pediatric endocrinologist in Glasgow, to generate a global registry for children with growth disorders so that we can capture some of this information, where investigators will enter their own data for their patients and then share that information globally. "The difference from the previous growth hormone registries is that this will now be where, when the companies have closed the registry, we as investigators can continue" he says. "And we can follow children into adulthood if they choose to remain."

For now, the JES paper authors hope that the model they established will help clinicians collect and easily interpret their own safety and efficacy data during long-term lonapegsomatropin therapy.

"You can pull out an app or a table on a laminated card, and you can say, this means the average level of IGF-1 is 20% more or 20% less than the one that you have measured at a particular time after administration, and you're okay, so let's keep the present dose. The whole thing is meant to be something quite practical." EN

– BAGLEY IS THE SENIOR EDITOR OF *ENDOCRINE NEWS*. HE RESEARCHED, COMPILED, AND WROTE THE 2021 PROGRESS REPORT IN THE DECEMBER ISSUE.

COMPREHENSIVE CARE FOR PERSONS WITH DIABETES:

A CERTIFICATE PROGRAM

LEARN INNOVATIVE APPROACHES TO DIABETES CARE AND IMPROVE PATIENT OUTCOMES WITH **COMPREHENSIVE CARE FOR PERSONS WITH DIABETES: A CERTIFICATE PROGRAM**.

Centered around 12 interactive, online modules available on-demand that cover the full span of diabetes care

Provides a certificate of course completion after passing comprehensive final exam

Built by experts from diverse backgrounds spanning endocrinology, nursing, and family medicine

Accredited for *AMA PRA Category* 1 credits, AOA Category 1-A CME credits, ANCC/COA credits, AAPA credits, and ABIM MOC points

IMPROVED KNOWLEDGE. SUPERIOR CARE.
FROM ENDOCRINOLOGISTS THAT KNOW BEST.

FOR MORE INFORMATION AND TO REGISTER, PLEASE VISIT ENDOCRINE.ORG/CCPD.

acofp AMERICAN COLLEGE OF OSTEOPATHIC FAMILY PHYSICIANS

ENDOCRINE SOCIETY

growth SPURT

How Pegvisomant Could Be a Promising Solution to a Big Problem

BY KELLY HORVATH

An excess of growth hormone in infancy leads to the rare yet confounding phenomenon of X-linked acrogigantism, which is known to be resistant to conventional pituitary tumor treatments in the pediatric population. However, new data suggest that pegvisomant could not only be a treatment option for these patients, but it could also improve quality-of-life measures.

When the hormonal axis that controls human growth is disrupted by a pituitary adenoma prior to epiphyseal closure (growth plate fusion), increased secretion of growth hormone and "pituitary gigantism" can result. When this condition is caused by a mutation in the *GPR101* gene on chromosome Xq26.3, it is known as X-linked acrogigantism (X-LAG), or chromosome Xq26 microduplication syndrome. The *GPR101* gene encodes for production of the *GPR101* protein that is thought to be involved with pituitary gland cell growth or in regulating the release of growth hormone from the pituitary.

Although X-LAG is rare, and its true prevalence is unknown, it is nevertheless thought to be responsible for 10% of cases of excessive growth in children with pituitary abnormalities. Having an X-linked dominant inheritance pattern, it is therefore more common in females.

In the May issue of the *Journal of the Endocrine Society*, a team of researchers led by Constantine A. Stratakis, MD, D(med) Sci, PhD(hc), senior investigator in pediatrics, endocrinology, and medical genetics at the National Institutes of Health (NIH): Intramural Research Program (IRP) and former scientific director of the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD) in Bethesda, Md., announced a study they are undertaking to fill a knowledge and treatment gap.

"Safety and Efficacy of Pegvisomant in Pediatric Growth Hormone Excess" describes their open-label Phase 3 study of the drug and their effort to provide data on children with growth hormone excess (GHE), also known as gigantism. To date, most available research has been done on adults.

Getting to this research question was no accident. Stratakis's younger brother was diagnosed with a pituitary tumor at the age of nine years, and Stratakis's career path was sealed: By high school graduation, he knew he wanted to become an endocrinologist. He chose the right path, later earning the distinction of being one of the scientists to discover the genetic cause of GHE (See sidebar).

> There are issues specific to gigantism, which is a unique disease. If we have a 4-year-old the size of a 7-year-old, this completely changes the dynamics of these kids, relationships with their peers, and their position in the family. **In the eyes of other kids or family members, we have an incongruity between behavior and size, similar to but the inverse of patients with extreme short stature."**
>
> — CONSTANTINE A. STRATAKIS, MD, D(MED)SCI, PHD(HC), CHIEF SCIENTIFIC OFFICER, ELPEN, ATHENS; DIRECTOR (RES. A'), HUMAN GENETICS AND PRECISION MEDICINE, FOUNDATION FOR RESEARCH AND TECHNOLOGY – HELLAS (FORTH), HERAKLION, CRETE, GREECE

Making Discoveries

Published in *The New England Journal of Medicine* in 2014, "Gigantism and Acromegaly Due to Xq26 Microduplications and *GPR101* Mutation" studied 43 children with early-onset gigantism. Inclusion criteria for the 43 study participants were pituitary lesions, height on country-specific growth charts of either more than the 97th percentile or more than two standard deviations above the mean height for age, and negative test results for mutations or deletions in genes associated with pituitary adenomas.

The team's findings showed that this striking phenotype they named X-linked acrogigantism is likely caused by an increased dose of *GPR101* on chromosome Xq26.3 and is characterized by early-onset gigantism (usually beginning by age 1 year in a normal-sized newborn) resulting from hypersecretion of growth hormone.

Though X-LAG is very rare, Stratakis explains that it accounts for 80% – 100% of pediatric GHE cases. The study also provided insight into human growth in general.

Searching for Treatment

The therapeutic picture is complicated. As the pediatrics mantra goes, children — even large-stature children — are not just little adults, so treatment approaches must be tailored to fit the pediatric population. Another consideration is that X-LAG tumors did not respond to therapy with octreotide, a somatostatin analogue and the conventional treatment for pituitary tumors.

In a study of 18 patients with X-LAG, the results of which were published in 2015 as "X-linked acrogigantism syndrome: clinical profile and therapeutic response," in *Endocrine-Related Cancers*, Stratakis and team further elucidated the clinical phenotype of these patients, such as acral enlargement, coarsened facial features, acanthosis nigricans, sleep apnea, excessive perspiration, and abdominal distention. Oversecretion of insulin-like growth factor 1 (IGF-1), also known as somatomedin, was another key feature, making the discovery of octreotide's lack of efficacy somewhat surprising.

"We started studying these patients at the NIH and realized there are not many treatment options besides octreotide or surgery," Stratakis says. "Irradiation is not really an option for very young kids. So, we started being interested in other medications that we could use."

Importantly, they found that postoperative use of adjuvant pegvisomant, a growth hormone receptor antagonist, provided some control. "We had some evidence from patients with Carney complex, which was resistant to octreotide," Stratakis continues. "These patients we had worked with for more than 25 years responded better to pegvisomant. And so, when we realized that patients with gigantism were not responding to octreotide, we thought pegvisomant might be a good option for them."

Fast forward to a couple of years ago, and the team connected with Pfizer, which worked with them to establish the current protocol. In the meantime, Stratakis retired from the NIH after almost 30 years there and passed on principal investigatorship to Christina Tatsi, MD, MHSc, PhD, also at the NIH, and they now work together on the research.

"There is currently no FDA-approved medication for this indication in children, and most of the treatments we provide are based on studies performed in adults," Tatsi says. Recruitment is currently ongoing (the COVID-19 pandemic having slowed progress); participants will include children ages 24 months to 18 years with GHE with persistent disease after surgical or radiation therapy. These patients will receive subcutaneous injections of pegvisomant daily for one year to determine its safety and efficacy.

Quality of Life

Although X-LAG is rare, with an incidence similar to that of other genetic endocrine conditions, such as McCune-Albright syndrome, Carney complex, and neurofibromatosis type 1, these patients must cope with reduced quality of life (QOL). "Overall, health-related quality of life is impaired with growth hormone excess, with improvement but not resolution after treatment; however, there is limited data in the pediatric population," says Meg Keil, PhD, CRNP, FAAN, a senior nurse practitioner and member of the research team at the NIH.

Stratakis agrees, citing the QOL issues associated with any pituitary tumor, such as complications of surgery like headaches or hypothalamic or partial or complete pituitary deficiencies. "All of these things affect QOL. They are common among the various patients with pituitary tumors who have had surgery or other modes of treatment that affect the function or the anatomy of the pituitary gland or

AT A GLANCE

- **X-linked acrogigantism (X-LAG) is characterized by infant-onset gigantism from hypersecretion of growth hormone.**
- **Although X-LAG does not respond to conventional pituitary tumor treatment, like octreotide, a new study is being conducted to evaluate the safety and efficacy of postsurgical pegvisomant, a growth hormone receptor antagonist, at preventing tumor recurrence.**
- **Secondary outcomes researchers hope to see improvement in associated complications such as musculoskeletal problems and in quality of life.**

His Brother's Keeper

Like so many who enter the field of endocrinology, for Constantine A. Stratakis, MD, D(med)Sci, PhD(hc), it was personal.

Constantine A. Stratakis's brother was diagnosed with craniopharyngioma, one of the most common pediatric brain tumors, that can be difficult to cure, with most patients experiencing long-term, chronic consequences. The tumor can put pressure on the structures near the pituitary gland, causing symptoms ranging from balance and vision problems; confusion, mood swings, and behavior changes; and headache, to polydipsia and polyuria, nausea and vomiting, and slow growth.

"I am reminded how much my brother's diagnosis changed our family when I see patients with pituitary tumors and their families," Stratakis says. "They often tell me that their ordeal did not end with surgery even when (if) they were cured. Their quality of life in most cases changed forever, and this is certainly true for my brother as well as for my parents." The one good outcome, he explains, is that it pushed him to go to medical school and indelibly set his career preference. "As an endocrine geneticist now, **I see many patients with rare disorders, not only pituitary tumors. And I get similar responses; often, a rare disease makes somebody in the family choose a career in healthcare or life sciences.**"

Stratakis grew up admiring his biologist and researcher uncle. "I loved biology in high school and was given a microscope as a teenager. This was my best gift ever; I spent hours looking at everything, from beer yeast to cheese crust. I then starting culturing microbes, to my mother's dismay. But I had never thought of becoming a physician. My brother's illness introduced me to medicine; furthermore, I realized that medicine was biology, and that biology could be used to investigate and even treat disease."

Stratakis says that once on his chosen path, he never thought of doing anything else: "**I love my work; it has changed many times over the years, and it keeps changing.** Now that I have retired from the NIH as a federal researcher after 30 years, I am building a new research institute in Greece from scratch — again, in the service of disease discovery, drug design, and the development of new therapeutics. These are on the continuum of biology: from the microscope I got as a child, to medical school, to the lab where we made so many discoveries, to the research institute I led at the NIH, to the one I am building now, it is all in medicine, yet each step is so different. Every day I learn a new skill, a new thing. It's never boring — sometimes tiring — but always exhilarating."

The legacy he has created (and keeps expanding) encompasses teaching, administration, and research. He trained more than 200 researchers as the NIH's scientific director, whose successes are already evident. He strove for diversity at the NIH, with more than 68% of his trainees being female, and initiated discussions for creating a program on transgender medicine. He also hopes that the new research institute he is building will be a significant achievement and lead to scientific breakthroughs. As a researcher, he worked on 35 genes and diseases, identifying six new genes and diseases, one that is even eponymous: Carney-Stratakis syndrome.

What he most appreciates, however, is helping people. "I served so many patients, including many with the disease that my brother had. **One can never fully pay back the fortune we had as a family to have my brother a healthy and productive member of our society, but part of my legacy will be that I tried to do it**," Stratakis says.

the hypothalamus," he says. "Then there are issues specific to gigantism, which is a unique disease. If we have a 4-year-old the size of a 7-year-old, this completely changes the dynamics of these kids and their relationships with their peers and their position in the family. In the eyes of other kids or family members, we have an incongruity between behavior and size, similar to but the inverse of patients with extreme short stature."

Treatment's Fringe Benefits

The team is clearly motivated to help these patients. "I hope the study will produce data for a safe and efficacious way for treatment of children with GH excess," Tatsi says. Stratakis elaborates: "Every one of our patients has had surgery, so, what I expect from the study is that pegvisomant will decrease the chances for recurrence. I think that is and has been my goal."

In many cases, the pituitary tumors cannot be completely excised, and the residual tumor causes chronic disease. "I don't expect this medication to make any residual tumor disappear, but I expect to have these patients in remission long enough to allow us to later use available modes of treatment like irradiation safely or avoid a second surgery for 10 or 20 years," Stratakis says.

Controlling that chronic disease also confers other benefits. "We anticipate that control of GH excess will provide also control of the complications of this disorder, such as cardiovascular changes, musculoskeletal problems, quality of life, and others," Tatsi says.

Pegvisomant looks promising, and the team hopes the study results will bear that out. Meanwhile, Stratakis has accepted a position as chief scientific officer, at ELPEN, in Athens, Greece, and director (Res. A'), Human Genetics and Precision Medicine at Foundation for Research and Technology – Hellas (FORTH). "It's wonderful work," he says, "and I continue my research into the genetics of endocrine diseases."

Expect to see papers on new genes soon. EN

> "I don't expect [pegvisomant] to make any residual tumor disappear, **but I expect to have these patients in remission long enough to allow us to later use available modes of treatment like irradiation safely or avoid a second surgery for 10 or 20 years."**
>
> — CONSTANTINE A. STRATAKIS, MD, D(MED)SCI, PHD(HC), CHIEF SCIENTIFIC OFFICER, ELPEN, ATHENS; DIRECTOR (RES. A'), HUMAN GENETICS AND PRECISION MEDICINE, FOUNDATION FOR RESEARCH AND TECHNOLOGY – HELLAS (FORTH), HERAKLION, CRETE, GREECE

– HORVATH IS A FREELANCE WRITER BASED IN BALTIMORE, MD. IN THE DECEMBER ISSUE, SHE RESEARCHED, COMPILED, AND WROTE THE ANNUAL EUREKA! ARTICLE THAT DETAILED THE TOP ENDOCRINE SCIENCE DISCOVERIES OF 2021.

BY KELLY HORVATH

Transgender Health:

Gender-Affirming *Hormone Therapy* and *Diabetes Risk*

New research published in *The Journal of Clinical Endocrinology & Metabolism* shows that transgender women may be at higher risk for type 2 diabetes compared to cisgender women, but not to cisgender men. However, there is little evidence that hormone therapy is the culprit.

As of 2016, 1.4 million adults identify as transgender or gender diverse (TGD). Transfeminine (TF) individuals were assigned male gender at birth, and transmasculine (TM) individuals were assigned female gender at birth. In the subsequent six years, the number of people identifying as TGD has likely increased significantly, as the 2022 U.S. Trans Survey (USTS) is expected to show.

Not surprisingly, as the number of those individuals who identify as transgender increases, healthcare providers are encountering more TGD patients in their practices.

An important priority of transgender health research is to better understand the metabolic changes induced by gender-affirming hormone therapy (GAHT), and a specific area of interest is the occurrence of type 2 diabetes.

Diabetes and the Transgender Population

The growth of this population has implications for clinicians, chief among them being the need to understand the healthcare issues TGD people uniquely face. A study published in the November issue of *The Journal of Clinical Endocrinology & Metabolism* (JCEM) charts new territory in beginning to uncover what these might be and how clinicians might approach them. In "Is There a Link Between Hormone Use and Diabetes Incidence in Transgender People? Data From the STRONG Cohort," Noreen Islam, MD, MPH, of the Emory University School of Medicine, in Atlanta, Ga., and team investigated whether the TGD population faces particular risks of prevalent (present at study initiation) or incident (not present at study initiation) type 2 diabetes.

Many TGD people opt for GAHT, which involves increasing estrogen and lowering testosterone in TF individuals and increasing testosterone in TM individuals. Thus, the need to understand how GAHT affects metabolism and the endocrine system is clear.

Islam, a third-year pediatric endocrinology fellow at Emory University, explains, "A part of receiving certification in the subspecialty of pediatric endocrinology is engaging in scholarly activities in addition to the core curriculum. I was interested in participating in an epidemiologic study as part of my scholarly activity during fellowship and was introduced to Michael Goodman, MD, MPH, a professor in the department of epidemiology at Rollins School of Public Health of Emory University. Dr. Goodman is part of the team who gathered data for the Study of Transition Outcomes and Gender (STRONG), the data set used for the study, and was my research mentor."

Participants selected from the STRONG cohort included 5,002 TGD adults ages 18 years and older matched to a reference group. Of that number, 2,869 (57%) were TF and matched to 28,300 cisgender

> "Although our data shows that GAHT does not seem to increase the risk for type 2 diabetes in transgender individuals compared to cisgender controls, **clinicians should continue to monitor the cardiometabolic status of transgender individuals."**
>
> — NOREEN ISLAM, MD, MPH, EMORY UNIVERSITY SCHOOL OF MEDICINE, ATLANTA, GA.

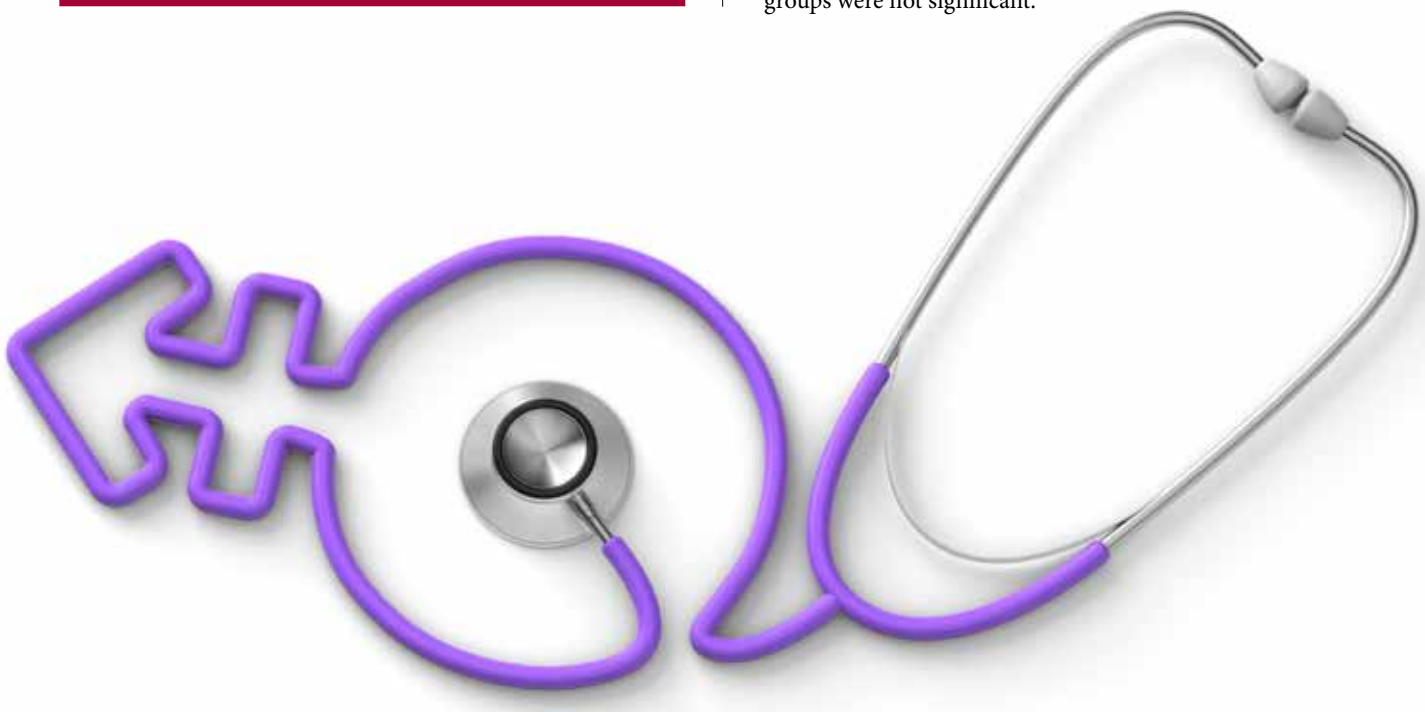
females (CFs) and 28,258 cisgender males (CMs); the 2,133 (43%) TM individuals were matched to 20,997 CFs and 20,964 CMs. At study initiation in 2006, 32% of TF individuals and 24% of TM individuals were on GAHT. The study continued through 2014 or follow-up through 2016.

In the TF group, type 2 diabetes was prevalent in 175 cases, compared to 77 cases in the TM group. Of these, 56 (32%) and 19 (34%), respectively, were on GAHT. The team found that baseline prevalence of type 2 diabetes was 61 per 1,000 participants (approximately 6%) both in the overall TF group and among TF participants on GAHT. The TM group showed 36 per 1,000 participants overall and 37 per 1,000 participants for those on GAHT (approximately 4%).

As for incident type 2 diabetes, the TF group had 94 cases, 17 (18%) of which were diagnosed after initiation of GAHT, and the TM group had 44 cases, 12 (27%) of which developed after starting GAHT. (The other incident cases occurred in TGD individuals either not on GAHT during the study period or who started GAHT after type 2 diabetes diagnosis.)

When the team compared type 2 diabetes cases in the TF group overall to the CF reference group, logistic regression analyses showed that TF individuals have higher odds of having prevalent type 2 diabetes (adjusted odds ratio estimate of 1.3) and higher risk of incident type 2 diabetes. Results of comparisons of other groups were not significant.

> “There is little evidence that type 2 diabetes occurrence in either transgender women or transgender men **is attributable to gender-affirming hormone therapy, at least in the short term.”**
>
> — NOREEN ISLAM, MD, MPH, EMORY UNIVERSITY SCHOOL OF MEDICINE, ATLANTA, GA.



Good News for GAHT

These findings that type 2 diabetes is more common among TF individuals compared with CFs but not CMs possibly reflects the known gender disparity in type 2 diabetes risk in the general population, with males being nearly twice as likely as females to develop the disease. While this may be related to the fact that TF individuals were assigned male at birth, the team did not specifically investigate this association. Rather, they were primarily concerned with whether GAHT affects diabetes risk, and, here, the news is encouraging. Although they hypothesized that they would see increased risk of type 2 diabetes with GAHT in both the TF and TM cohorts compared to cisgender controls, their results show that, when the analysis was restricted to TGD participants on GAHT, type 2 diabetes risk did not increase.

"However," Islam says, "although our data shows GAHT does not seem to increase the risk for type 2 diabetes in transgender individuals compared to cisgender controls, clinicians should continue to monitor the cardiometabolic status of transgender individuals." Meanwhile, data from STRONG will continue to be analyzed with the goal of improving the health status of TGD individuals.

Islam adds that although more research is needed, "there is little evidence that type 2 diabetes occurrence in either transgender women or transgender men is attributable to gender-affirming hormone therapy, at least in the short term."

Other authors of the study include: Rebecca Nash, Qi Zhang, and Michael Goodman of Emory University in Atlanta, Ga.; Leonidas Panagiotakopoulos, Tanicia Daley, and J. Sonya Haw of Emory University School of Medicine; Shalender Bhasin of Brigham and Women's Hospital and Harvard School of Medicine in Boston, Mass.; Darios Getahun of Kaiser Permanente Southern California and Kaiser Permanente Bernard J. Tyson School of Medicine in Pasadena, Calif.; Courtney McCracken of Kaiser Permanente Georgia in Atlanta, Ga.; Michael J. Silverberg of Kaiser Permanente Northern California in Oakland, Calif.; Vin Tangpricha of Emory University School of Medicine and the Atlanta VA Medical Center in Atlanta, Ga.; and Suma Vupputuri of Kaiser Permanente Mid-Atlantic States in Rockville, Md.

The research received funding from the Patient-Centered Outcomes Research Institute and the National Institute of Health's *Eunice Kennedy Shriver* National Institute of Child and Human Development.

The manuscript, "Is There a Link Between Hormone Use and Diabetes Incidence in Transgender People? Data from the STRONG Cohort," was published online, ahead of print at: **https://bit.ly/3nboo3e**.

– HORVATH IS A FREELANCE WRITER BASED IN BALTIMORE, MD. IN THE DECEMBER ISSUE, SHE RESEARCHED, COMPILED, AND WROTE THE ANNUAL EUREKA! ARTICLE THAT DETAILED THE TOP ENDOCRINE SCIENCE DISCOVERIES OF 2021.

AT A GLANCE

- The metabolic changes induced by gender-affirming therapy (GAHT) are not well understood, particularly as they relate to prevalent and incident type 2 diabetes.
- Transfeminine people may be at higher risk for diabetes compared with cisgender females.
- This study showed little evidence that type 2 diabetes occurrence in either transfeminine or transmasculine individuals is attributable to GAHT in the short term.

sex, race, and MEASURING TAPE: Health Disparities and Growth Hormone Deficiency

BY ERIC SEABORG

Racial and gender disparities in healthcare begin early — including among children who could benefit from treatment for short stature. New research seems to show that white children — especially boys — are offered growth hormone stimulation tests at a significantly higher rate than girls or Black and Hispanic children.

The racial, ethnic, and gender disparities known to exist in the healthcare system are clearly present in the diagnosis and treatment of growth hormone deficiency, according to several recent studies that explore the underlying causes.

Males are twice as likely as females to receive pediatric growth hormone treatment in the U.S., despite having similar distributions of the height scores used to identify those who might benefit from intervention. To investigate the causes of this disparity, a team of researchers led by Camilia Kamoun, MD, of the Children's Hospital of Pennsylvania in Philadelphia, reviewed the charts of more than 10,000 children ages 2 to 16 years who had been evaluated for short stature or poor growth at a large tertiary referral center between 2012 and 2019.

In an article published in *Hormone Research in Paediatrics*, the researchers report that boys were administered growth hormone stimulation testing

at a higher rate than girls and that boys were given tests when their heights were closer to normal.

The rate that boys and girls were tested — and therefore diagnosed — was important because once girls were diagnosed with growth hormone deficiency (GHD) they received growth hormone treatment at the same rate as boys, but they were not given GH stimulation testing at the same rate.

Who Worries about Short Stature?

"This is the first study to describe sex differences in GH stimulation testing as a factor contributing to sex disparities in pediatric GH treatment," the authors write. The authors reviewed potential reasons for the disparity in testing rates, starting with the strong social notion that "short stature is associated with heightened concern when present in boys compared to girls in primary care."

The greater concern for the condition in boys could contribute to disparities at each step on the road to treatment, they write: "Males are more likely to be screened by primary care clinicians for GHD and to be referred to a pediatric endocrinologist for evaluation of short stature. Pediatric endocrinologists are also more likely to prescribe GH treatment to boys than girls, when this was assessed in theoretical cases of short non-GHD children. In a survey of parents of pediatric primary care patients, the acceptable height cutoff regarding short stature was higher for male versus female heights."

The researchers conclude that their findings raise "questions about the extent to which sex bias — from children, parents, and/or physicians — as opposed to objective growth data, influence medical decision-making in the evaluation and treatment of short stature."

They note that overcoming this bias is important because of a study that showed that "in a population of children referred to endocrinologists for evaluation of short stature, 41% of girls, compared with 15% of boys, were found to have organic disease."

"Critical self-reflection to identify and address sex biases that may impact care is one step clinicians can take to mitigate potential associated harms. Such harms may include underdiagnosis of GHD in girls and overtreatment of short stature in boys," they conclude.

"The rate that boys and girls were tested — and therefore diagnosed — was important because once girls were diagnosed with growth hormone deficiency (GHD) they received growth hormone treatment at the same rate as boys, **but they were not given GH stimulation testing at the same rate."**

Racial and Ethnic Angle

A related group from the Children's Hospital of Philadelphia, this one led by Colin Patrick Hawkes, MD, PhD, performed a similar chart-review study to look at racial and ethnic differences. Published in *The Journal of Pediatrics*, the study found that non-Hispanic white children were 1.4 times more likely than non-Hispanic black and 1.7 times more likely than Hispanic children to undergo growth hormone stimulation testing.

But the researchers note that being tested is only one step, and that the imprecision of the test "may introduce an opportunity for bias in treatment decisions." Patients whose results clearly fell within the generally accepted range for deficiency received treatment at similar rates regardless of race or ethnicity. But the test results can also fall into a "gray zone where GH prescribing is more discretionary." In these cases, non-Hispanic Black children were less likely than non-Hispanic white and Hispanic children to receive GH treatment.

"Racial and ethnic disparities in care have been found across the spectrum of pediatrics, including across rates of well-

AT A GLANCE

- Boys are offered growth hormone stimulation testing at a higher rate than girls, one potential factor contributing to males being twice as likely as females to receive pediatric growth hormone treatment, according to a new study.
- White children are given growth hormone stimulation tests at much higher rates than Black or Hispanic children.
- Males are seen by endocrinologists, given growth hormone stimulation tests, and prescribed growth hormone at less severe height deficits than females at each of those steps, and white males are more likely to receive growth hormone treatment than their peers from minority groups.

child visit attendance and subsequent subspecialty service use," the authors note, and these disparities could contribute to fewer opportunities for children from minority groups to see the needed specialists. The researchers blame the disparities on "overinvestigation" of white children coupled with "underinvestigation and undertreatment of children from minority communities."

The Burden of Undertreatment

A third paper, this one in the *Journal of Managed Care & Specialty Pharmacy*, did not look specifically for gender and racial disparities, but it found them anyway. It found that among patients with commercial insurance, 71% of males and 61% of female patients who were diagnosed with growth hormone deficiency were treated. Among Medicaid patients, 66% of white patients and 55% of black patients diagnosed with GHD were treated. The time from diagnosis to treatment provided another measure of the disparity among Medicaid patients.

Researchers found a mean of 138 days in white males, 141 days in Hispanic males, 182 days in Black males, 180 days in white females, 188 days in Hispanic females, and 220 in Black females.

The main thrust of the paper was to look at the significance of the undertreatment, according to Paul Kaplowitz, MD, PhD, one of the authors and professor emeritus of pediatrics at Children's National Hospital in Washington, D.C. "The paper makes the point that treatment with growth hormone seemed to reduce the cost of nongrowth hormone prescription care," he tells *Endocrine News*.

The authors concluded that "untreated GHD is associated with higher non-somatotropin healthcare costs compared with treated GHD, further indicating a need to improve adherence to treatment."

"The evaluation and treatment of children with short stature should be determined by clinical concern alone, but this is not current practice," the authors of *The Journal of Pediatrics* article conclude. EN

For More Information

Kamoun C, Hawkes CP, Gunturi H, et al. Growth hormone stimulation testing patterns contribute to sex differences in pediatric growth hormone treatment. Horm Res Paediatr. 2021 Oct 18:275–85. doi: 10.1159/000520250.

Hawkes CP, Gunturi H, Dauber A, et al. Racial and ethnic disparities in the investigation and treatment of growth hormone deficiency. J Pediatr. 2021 Sep;236:238–45. doi: 10.1016/j.jpeds.2021.04.034.

Kaplowitz P, Manjelievskaia J, Lopez-Gonzalez L, et al. Economic burden of growth hormone deficiency in a U.S. pediatric population. J Manag Care Spec Pharm. 2021 Aug;27(8):1118–28. doi: 10.18553/jmcp.2021.21030.

– SEABORG IS A FREELANCE WRITER BASED IN CHARLOTTESVILLE, VA. HE WROTE THE JANUARY COVER STORY ON ENDOCRINOLOGY AND CLIMATE CHANGE.

Endocrine Society Advocacy in the European Union Influences Regulations on BPA

On December 15, 2021, the European Food Safety Agency (EFSA) published a draft revised Tolerable Daily Intake (TDI) level for bisphenol-A (BPA), an endocrine-disrupting chemical (EDC) commonly used in plastics, can linings, and other potential sources of human exposure via food contact materials.

> **“We enthusiastically support the conclusion that there exists evidence of harm due to BPA exposure even at extremely low levels and the necessity of minimizing exposure to BPA and other endocrine disruptors.”**

The new TDI is much lower than previous assessments, following from the latest scientific information on health harms associated with BPA; in fact, the new TDI of 0.04 nanograms per kilogram of body weight per day is five orders of magnitude lower than the previous TDI dating from 2015. Importantly, the new estimate implies that levels of consumer exposure to BPA is of concern for public health across demographics and age groups, with particular attention paid to effects on the immune system and reproductive health.

The Endocrine Society, led by our BPA and European Union (EU) Task Forces, has been heavily involved in the revised BPA assessment protocol used to derive the new TDI. In 2017, we submitted public comments to EFSA applauding their overall approach to evaluate the scientific literature and made detailed suggestions that would enable the protocol to strengthen conclusions and clarify important scientific issues. In 2018, we submitted another letter to EFSA encouraging the panel charged with evaluating the science on BPA to include important data collected prior to 2013 in the revised assessment. In all our communications with EFSA, we shared the latest scientific references from the peer-reviewed literature about links between BPA exposure and endocrine disruption.

While the final assessment could be improved in some ways to better incorporate certain aspects of endocrine science, we enthusiastically support the conclusion that there exists evidence of harm due to BPA exposure even at extremely low levels and the necessity of minimizing exposure to BPA and other endocrine disruptors. The Society will submit comments to EFSA in support of the conclusion, identify improvements to the opinion that give further support to the revised TDI, and encourage EFSA to direct additional scrutiny to replacement chemicals with similar properties to BPA to avoid regrettable substitutions.

Federal Funding for Scientific Research in the U.S. Expires February 18

Congress' primary responsibility is to fund the federal government each fiscal year beginning October 1 through September 30.

As this issue of *Endocrine News* went to press, we were three months into the federal fiscal year, and Congress still had not finalized annual appropriations legislation that funds the National Institutes of Health (NIH), Centers for Disease Control and Prevention (CDC), and all other federal agencies.

Instead, to avert a government shutdown, Congress passed a temporary measure known as a continuing resolution to keep the federal government operating at the previous year's funding levels through February 17, 2022. The problem with the continuing resolution is that it provides no increases and, because it is temporary, federal agencies hold back some of their funding because they do not know what will happen next. This results in cuts for biomedical research and delays in study section reviews.

Take Action

The Endocrine Society continues to meet with congressional offices to advocate that Congress pass a final appropriations bill with increases for the NIH and CDC rather than another continuing resolution, but it is critical that your representative and senators hear from you as a constituent. Please visit our website at: **endocrine.org/takeaction** for the latest news about funding and for how you can join our online advocacy campaign. These campaigns really do work and can make the difference for your grants being funded or not.

NIDDK Strategic Plan Includes Endocrine Society Priorities

Just before the new year, the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) released a five-year Strategic Plan for Research to accelerate research into the causes, treatment, and prevention of diseases and conditions within the Institute's mission. The plan arrives after well over a year of thoughtful discussion and input from stakeholders, and the Endocrine Society gave expert feedback throughout the development and drafting of the plan.

We are pleased to report that the Plan clearly reflects many of the Endocrine Society's research and health priorities. For instance:

- Scientific Goal 1 includes important objectives related to environmental contributors to health and disease, research on factors such as nutrition and circadian rhythm, and other topics that encourage collaborations at the intersection between the NIDDK and other NIH institutes and centers.
- Scientific Goal 1 also incorporates our suggestion to call for bedside-to-bench research on successful interventions to explore their mechanistic bases and expand their therapeutic potential.

- Scientific Goal 3 includes an emphasis on multidisciplinary studies to enhance dissemination and implementation research.

Furthermore, several cross-cutting themes that we enthusiastically support were built into the plan. The plan often notes the importance of studying health disparities in the context of diseases within the NIDDK's mission, and we are glad to see thatthe NIDDK will continue to prioritize research on the causes of health disparities and how these disparities can be eliminated through the development and testing of diagnostics, therapeutics, and prevention strategies.

> **“We are glad to see that the NIDDK will continue to prioritize research on the causes of health disparities and how these disparities can be eliminated through the development and testing of diagnostics, therapeutics, and prevention strategies.”**

We also support the plan's acknowledgement of the need to increase the diversity of participants in clinical trials to help understand the underpinnings of health disparities. Moreover, basic research was highlighted throughout the draft plan, both in the context of research objectives and as a training objective to encourage recruitment of students into basic science areas within the NIDDK's mission.

National Clinical Care Commission Submits Report to Congress

The National Clinical Care Commission submitted its report to Congress and the Secretary of Health and Human Services (HHS) in January 2022. The report outlines the commission's evidence-based findings and recommendations for improving federal diabetes prevention and treatment programs and includes Endocrine Society recommendations related to insulin affordability, diabetes prevention, treatment, and research.

Endocrine Society member William H. Herman, MD, MPH, chaired the commission and Endocrine Society member Carol Greenlee, MD, served on the commission. During the commission's term from 2018 to 2021, the Endocrine Society provided feedback and recommendations to the commission as it developed its recommendations to improve federal programs related to diabetes.

The commission's full report and recommendations can be found at: **https://health.gov/about-odphp/committees-workgroups/national-clinical-care-commission**. EN

KEEP YOUR PRACTICE CURRENT

2021 Endocrine Case Management: Meet the Professor is designed to provide physicians with a concise and high-quality review of more than 45 common and rare endocrine disorders. Enjoy access to case-based clinical vignettes and rationales by experts in all areas of endocrinology, diabetes, and metabolism.

Certified for 30.0 *AMA PRA Category 1 Credits*™.

AVAILABLE AS AN E-BOOK.
ENDOCRINE.ORG/STORE

ENDOCRINE SOCIETY

Clinical Endocrinologist Position at Ann Arbor Endocrinology and Diabetes Associates

Independent endocrinology practice seeking full time clinical endocrinologist to join busy practice in Ann Arbor, MI.

Applicants must have an MD (or foreign equivalent), board certification in Internal Medicine and completed an ACGME accredited Endocrinology Fellowship, board certified or eligible in Endocrinology.

Clinical teaching through resident education and opportunities for future partnership available.

To apply, please send CV to Joanna Nolff at
joanna.nolff@stjoeshealth.org

YOU CARE FOR OTHERS—
WE'RE HERE TO HELP YOU
CARE FOR YOUR CAREER.

DISCOVER YOUR NEXT OPPORTUNITY ON THE LARGEST SOURCE FOR ENDOCRINE JOBS.

BROWSE JOBS NOW AT
ENDOCRINE.ORG/ENDOCAREERS

ENDOCRINE SOCIETY

ENDO2022

JUNE 11–14, 2022 ATLANTA, GEORGIA AND ONLINE

EARLY RATES AVAILABLE NOW

REGISTER FOR ENDO 2022

TAKE ADVANTAGE OF OUR BEST PRICING

ENDOCRINE.ORG/ENDO2022

ENDOCRINE SOCIETY