Vol. 43 No. 1 • 2026

Biometric BULLETIN

"Biometry, the active pursuit of biological knowledge by quantitative methods." - R.A. Fisher, 1948

International Biometric Society Internationale Biometrische Gesellschaft Société International de Biométrie

President's CORNER

María Gabriela Cendoya
International Biometric Society President

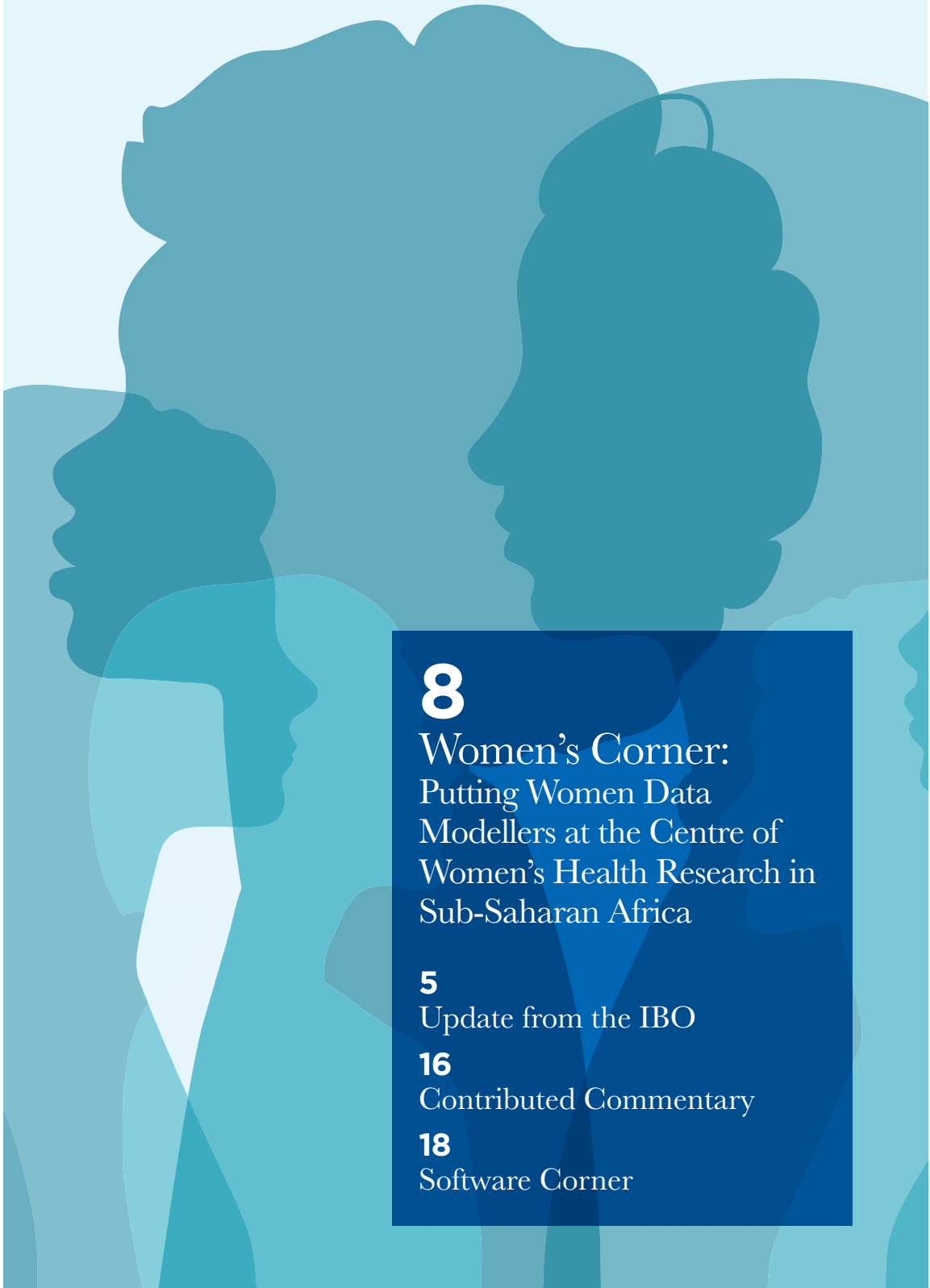
Dear Members of the International Biometric Society,

It is with great honor and deep gratitude that I address you for the first time as President of the IBS. I sincerely thank you for the trust you have placed in me. This role represents both a significant challenge and a unique opportunity, and I am fully committed to dedicating my energy and effort to serve our Society and its members.

As many of you may not know me personally, allow me to briefly introduce myself. I am a Professor at the Faculty of Agricultural Sciences and Director of the Research Group on Statistics and Experimental Design, both at the Universidad Nacional de Mar del Plata in Argentina. My professional career has been devoted to the application of statistical methods in the agricultural and biological sciences, with a strong focus on ensuring that methodological rigor translates into solutions that address real problems in these fields.

Within the IBS, I have had the privilege of serving in

Continued on Page 4



Biometric BULLETIN

ISSN 8750-0434

Biometric Bulletin is typically published four times a year in
March, June, September, and December.

International Biometric Society
1120 20th Street, NW, Suite 750 • Washington, DC 20036-3441 USA
Telephone: +1 (202) 712-9049 • Fax: +1 (202) 216-9646
Email: ibs@biometricsociety.org Website: http://www.biometricsociety.org

The *Biometric Bulletin* is available to members of the Society as part of their membership dues.

Region Key

Regions

RArg - Argentinean Region
AR - Australasian Region
ROeS - Austro-Swiss Region
RBe - Belgian Region
Benin - Benin Region
GBot - Botzwanian Region
RBras - Brazilian Region
BIR - British and Irish Region
RCAC - Central American-Caribbean Region
GCmr - Cameroon Region
GCl - Chilean Region
CHINA - Chinese Region
CROA - Croatian Region
EMR - Eastern Mediterranean Region
ENAR - Eastern North American Region
ECU - Ecuadorian Region
GEth – Ethiopian Region
RF - French Region
DR - German Region
GGha - Ghanian Region
IR - Indian Region
RItl - Italian Region
JR - Japanese Region
GKe – Kenyan Region
RKo - Korean Region
GMal - Malawi Region
NAM - Namibian Region
GNi – Nigerian Region
NR - Nordic-Baltic Region
GPol – Polish Region
GRo – Romanian Region
RWAN - Rwanda Region
GSaf – South African Region
REsp - Spanish Region
ANed - The Netherlands Region
GUgan – Ugandan Region
WNAR - Western North American Region
GZim – Zimbabwean Region

Networks

CEN – Central European Network
CN – Channel Network
EAN – East Asian Network
HISP – Hispanic International Network
SUSAN – Sub-Saharan Network

Biometric BULLETIN

8

Women's Corner

8 - Women's Corner
Halima S. Twabi, PhD focuses on strengthening analytical leadership in women's health research in Sub-Saharan Africa, emphasizing the importance of developing statistical capacity and supporting women data modellers working at the interface of methodology and public health.

13

STRengthening Analytical Thinking for Observational Studies (STRATOS): TG6 – Overview and Guidance of Performance Measures for Clinical Prediction Models

The STRATOS initiative provides an overview of performance measures for clinical prediction models and offers guidance on their appropriate interpretation and use.

21

Regional News

The Regional News section provides a snapshot of the vibrant activities taking place across our global network. In this issue we see examples ranging from announcements of upcoming scientific meetings, such as the Pacific Causal Inference Conference in China and the Panhellenic and International Statistics Conference in Greece, to reports on student-focused initiatives like the SEB Student Conference of the Spanish Region.

PRESIDENT'S CORNER

Continued from page 1

several capacities. In the Argentine Region, I held various leadership roles, including two terms as Regional President. I was elected by my colleagues to represent them in the Representative Council from 2011 to 2014, and later by the Society's members to serve on the Executive Board from 2021 to 2024. These experiences have been invaluable in shaping my vision for our community and reinforcing my commitment to advancing the mission of the IBS.

I understand the IBS as a federation of regions, each with its own identity and traditions. Their diversity enriches us simply by being part of our Society, and we are strengthened by the qualities they bring. At the same time, it is a challenge to interpret and respect these differences. During my presidency, I intend to concentrate on strengthening the relationship with members across regions, so that they become more aware of the benefits of belonging to such an inclusive society. This could allow us to benefit from the contributions of many colleagues who, until now, have remained silent but whose voices and ideas might enrich our community. I am open to hearing from you and to learning more about your activities as regions, and I encourage you to remember that each region has representatives in the Council, which is the natural path to convey your ideas and strengthen our collective work.

This year we are fortunate to meet again in person at the IBC 2026, to be held in Seoul from July 4 to 7. For those members who have already experienced one of these conferences, we know how extraordinary they are: once you attend your first IBC, you will do everything possible to join the next. These meetings not only enrich us with scientific knowledge, but they also comfort our spirit as we reconnect with wonderful people who share our path in biometrics. We look forward to welcoming all of you in Seoul.

All the best,

María Gabriela Cendoya
International Biometric Society President

FROM THE EDITOR

Welcome to the first issue of the *Biometric Bulletin* for 2026 - it is a bumper edition! As I begin my second year as Editor, I would like to thank the many regional correspondents, contributors, and members of the International Biometric Office who help bring each issue together. The *Bulletin* is a collective effort and reflects the energy and diversity of activities across the International Biometric Society.

This issue starts with the inaugural contribution from our new President, María Gabriela Cendoya, who reflects on the role of the International Biometric Society as a global federation of regions and the importance of strengthening connections across our diverse membership. In the Update from the IBO, our Executive Director, Peter Doherty, valiantly attempts to recognise as many individuals as possible for their contributions to the Society. Volunteers are the lifeblood of the IBS, and this update serves as a reminder of the many people who give their time and expertise to support the Society's activities, from committee work and mentoring initiatives to journal leadership and regional engagement.

The Women's Corner focuses on strengthening analytical leadership in women's health research in Sub-Saharan Africa, emphasizing the importance of developing statistical capacity and supporting women data modellers working at the interface of methodology and public health. We also include a contribution from the STRATOS initiative that provides an overview of performance measures for clinical prediction models and offers guidance on their appropriate interpretation and use. In addition, this issue marks the return of the Software Corner, introducing the RobinCar2 R package, which provides tools for robust covariate adjustment in randomized clinical trials.

The Contributed Commentary section is new to the *Biometric Bulletin*, and our first article reflects the opinions of some IBS members from the University of Granada, Spain. By publishing this content, the Biometric Bulletin aims to provide a platform for constructive discussion within the region and more broadly across the Society. Questions around training, curriculum design, and the future of biostatistical

Continued on Page 6

Update FROM THE IBO

Peter Doherty
Executive Director

What a year it has been so far! That said, and though we are already deep into February as of this writing, I wanted to take this opportunity to share a review of the past year from a Society perspective and thank some of the volunteers that I did not have a chance to recognize in our final edition of 2025. This will be a continuation of sorts from the last issue, but important. Volunteers are the lifeblood of the Society, and their support of the organization, the Regions, and their local communities, should never go unnoticed.

First, I must recognize our Treasurer Sarah Ratcliffe (ENAR Region) for her leadership during 2025. The Society's financial picture remains quite strong, by the way, which helps us to serve our members and the profession as a whole. Sarah is also the author of a new *Biometric Bulletin* column designed to focus on the financial picture, budget development and related matters, which you will see once again in the next *Biometric Bulletin*. I also wish to mention that our Secretary, Tarylee Reddy (South African Region), has made enormous progress in connecting many colleagues from several African countries to the IBS during the past year, resulting in a number of new, vibrant Regions! We were fortunate that the membership decided to renew Sarah's and Tarylee's terms through a recent online vote. They will continue to serve Society members through the end of 2027. Thanks to you both!

Outgoing Representative Council Chair Tim Friede (German Region) also deserves a high degree of praise, as he presided over a very productive Council term that ended in December. Four task forces studied sustainability efforts, the benefits of Society membership, and opportunities for collaboration and engaging with younger colleagues across Regions and other topics. He is succeeded by Xavier Barber (Spanish Region), who recently hosted his first meeting and welcomed nearly thirty new Rep Council members. Best wishes for an excellent year!

The progress being made by our committees is becoming more and more important as the Society continues to develop. Thanks to our outgoing committee Chairs, Vilda Purutcuoglu (Eastern Mediterranean Region – Awards Fund Committee) and David Warton (Australasian Region - Editorial Management Committee), for their years of service! Thanks also to all of our outgoing committee members! We look forward to recognizing you all in Seoul. And remember that you are all welcome to consider new roles in the future, not to mention enrollment in the new Volunteer Pool. Contact my colleague Ryan Dee at ibs@biometricsociety.org if interested in being involved in this new opportunity, giving you the chance to get involved in a variety of short-term volunteer projects that will be launched soon. Not a volunteer? This is an easy way to start!

A few in our community prefer long-term projects, some of which might take months, years or even decades to complete! For example, long-time volunteer, Past President, and author of *The History of the Biometric Society – 1st Edition*, Lynne Billard (ENAR Region), continues to work with us as we establish our new physical archive at Iowa State University in the U.S. We appreciate the countless hours that Lynne has spent compiling our Society's history. Lynne looks forward to a bit of open space on her desk very soon! And I should also mention Past President Louise Ryan for continuing to shepherd our growing Mentorship Program, with assistance from Tarylee Reddy and our IBO Administrator Ryan Dee. We will once again be offering an in-person Mentorship Lounge at the 2026 IBC in Seoul, sponsored by J&J! And current *Biometrics* Executive Editor, Geert Molenberghs, has consented to continue on for one additional term, for which we are extremely grateful! Thanks also to Matthew Schofield (Australasian Region), who completed a successful Co-Editor term in December.

I can't forget to mention all of the volunteers who offered their perspectives, expertise and important updates on recent papers through our Journal Club and Distinguished Lecture Series. Remember that all 2025 programs are available online for viewing by members free of charge. The Education Committee is hard at work lining up speakers for the 2026 Distinguished Lecture series. Look for an official announcement soon.

I have focused now on our volunteers in two IBO articles, and perhaps I still have not recognized everyone I should. It's certainly possible! But please just know that the IBO and your Board appreciate your time and efforts. And finally, though not a "volunteer" group per se, I also wanted to thank all of the IBS members who agreed to donate to the Travel Awards program in late 2025 and early 2026. We have certainly seen an uptick of support in recent months, and 100% of these donations will be spent on travel grants to support our colleagues in lower and middle-income countries. With local and regional challenges facing many of our readers, your financial assistance is helping the Society's presence to be felt far beyond our office in Washington, and I know that our grant recipients appreciate it. We hope you will have the opportunity to congratulate some of them in Seoul this July.

As always, you are welcome to reach out to the IBO with questions or suggestions. We are here for you!

Best wishes,

Peter Doherty, CAE
Executive Director

FROM THE EDITOR

Continued from page 4

education are relevant to all of us, and I hope this contribution encourages further dialogue among members. We welcome similar contributions from colleagues who would like to share their experiences with the Society - perhaps there is an initiative you've contributed to that has successfully addressed some of the challenges identified here.

The Regional News section provides a snapshot of the vibrant activities taking place across our global network. In this issue we see examples ranging from announcements of upcoming scientific meetings, such as the Pacific Causal Inference Conference in China and the Panhellenic and International Statistics Conference in Greece, to reports on student-focused initiatives like the SEB Student Conference of the Spanish Region. It is always encouraging to see such strong activity and engagement across the regions!

Garth Tarr
Biometric Bulletin Editor

International Biometric Conference

IBC

12-16 July 2026

Seoul, South Korea

Your Research, Center Stage in Seoul

Held in Seoul, South Korea from 12 – 16 July, 2026, the International Biometric Conference (IBC) invites statisticians, mathematicians, biological scientists, post-docs, students, and interdisciplinary enthusiasts interested in fostering advancements in biometry and the biosciences. Learn more about the conference, the mixing of traditional and innovative new programming, special city tours and social events, and all of our activities by visiting www.ibc2026.org.

Reserve your spot today to join 700+ colleagues at IBC2026.

Register Now

internationalbiometricsociety.regfox.com/33rd-international-biometric-conference-2026

What to Expect:

- **Experience an international exchange of ideas in an intimate and welcoming environment.**
- **High-caliber research with a focus on biometry and statistics.**
- **Short courses, mentoring, and sessions designed for early-career and established professionals alike.**

New for 2026, the IBC brings you a wide *variety of showcases, keynotes, panels and other special sessions!

* The exact lineup is subject to change without notice.

Special Invited Session - Spotlight on the Korean Region
A session celebrating our host region and the Korean biostatistical community.

Women in Biostatistics Special Session
A celebration of the achievements and impact of women in biostatistics.

Bioethics Roundtable
A cross-disciplinary discussion exploring ethical considerations.

Stat In Practice Showcase
"Implementing causal discovery in epidemiological and clinical research"

Young Researchers Showcase and Panel
Research presentations and a live career panel with a focus on the next generation of biometricians.

IBS Regional Networks Showcase
Highlights notable talks from members of the five IBS Regional Networks.

Young Statisticians' Showcase (YSS)
Recognizes one award-winning young statistician from each of the five continental areas of the world.

ISI Young Ambassador to IBC Showcase
A featured session developed by the IBS in partnership with the International Statistical Institute.

Women's CORNER

Putting Women Data Modellers at the Centre of Women's Health Research in Sub-Saharan Africa

Halima S. Twabi, PhD
On behalf of the SWRNAC-Project Team
Research collaborators: Inger Fabris-Rotelli, Tarylee Reddy, Esnat Chirwa, Nonhlanhla Yende-Zuma, Nada Abdelatif, Shibe Mhlongo, Iliana Kohler

When we talk about women's health in Sub-Saharan Africa, the conversation often focuses on outcomes: maternal mortality, HIV, reproductive health, nutrition, mental health, and the rising burden of non-communicable diseases. These are urgent priorities. But behind every statistic is a deeper question we do not ask often enough:

Who is analysing the data?

Who is building the models that shape policy decisions about women?

Who is interpreting the results?

Who is deciding which disparities are highlighted and which remain invisible?

These questions sit at the heart of our project "Strengthening Women's Research Networks and Capacity to Address Women's Health in Sub-Saharan Africa" The project was born from the belief that strengthening women's health research requires more than collecting data. It requires building strong analytical capacity and placing women data modellers at the centre of that effort.

Across Sub-Saharan Africa, large and rich datasets are increasingly available. From demographic and health surveys to routine health systems and longitudinal studies, we are not short of information. Yet the capacity to conduct advanced statistical modelling often remains limited. Too frequently, complex analyses are outsourced or led externally, and local researchers, especially women, are underrepresented in high-level data science and biostatistics roles.

Our project places training women data modellers at the centre of strengthening women's health research. We focus on equipping early- and mid-career researchers with coding skills in R and Python, strong foundations in statistical thinking, and advanced statistical methods, and capacity building through support for Masters and PhDs. But beyond technical training, we emphasise something equally important: research through a gender lens.

What does this mean in practice?

It means asking whether an intervention works differently for women and men and why. It means examining how structural inequalities shape exposure, access to care, and outcomes. It means recognising that biological, social, and economic dimensions of gender interact in complex ways that must be modelled carefully and interpreted responsibly.

A gender lens changes the research conversation. It pushes us to move beyond averages and uncover disparities. It encourages us to question assumptions embedded in study design and variable selection. It reminds us that behind every dataset are lived realities shaped by power, culture, and opportunity.

When women are trained and confident in advanced quantitative methods, they are better positioned to interrogate these complexities. They can design analyses that go beyond averages. They can challenge assumptions embedded in datasets. They can ensure that findings reflect lived realities rather than simplified narratives.

Collaboration is central to this work. Our project is implemented through partnerships across universities and research institutions in South Africa and Malawi. These collaborations allow us to share expertise and create cross-country learning networks. Researchers from different institutions engage in joint workshops, mentorship programmes, and collaborative analyses focused on women's health priorities in the region.

This cross-institutional approach strengthens both individual and institutional capacity. It promotes sustainability, encourages South–South collaboration, and fosters a community of practice where women statisticians and data scientists support one another's growth.

Importantly, this work also creates visible role models. When young women see other women leading data science projects, teaching advanced methods, and publishing rigorous analyses, the boundaries of what feels possible expand. Representation matters particularly in quantitative fields where women have historically been underrepresented.

Strengthening women's health research is not only about improving outcomes; it is about transforming how knowledge is produced. By investing in women data modellers and embedding a gender lens in statistical training, we are building a generation of researchers who can generate rigorous, context-sensitive evidence that truly reflects the realities of women in Sub-Saharan Africa.

THE JOURNAL OF AGRICULTURAL, BIOLOGICAL, AND ENVIRONMENTAL STATISTICS (JABES)

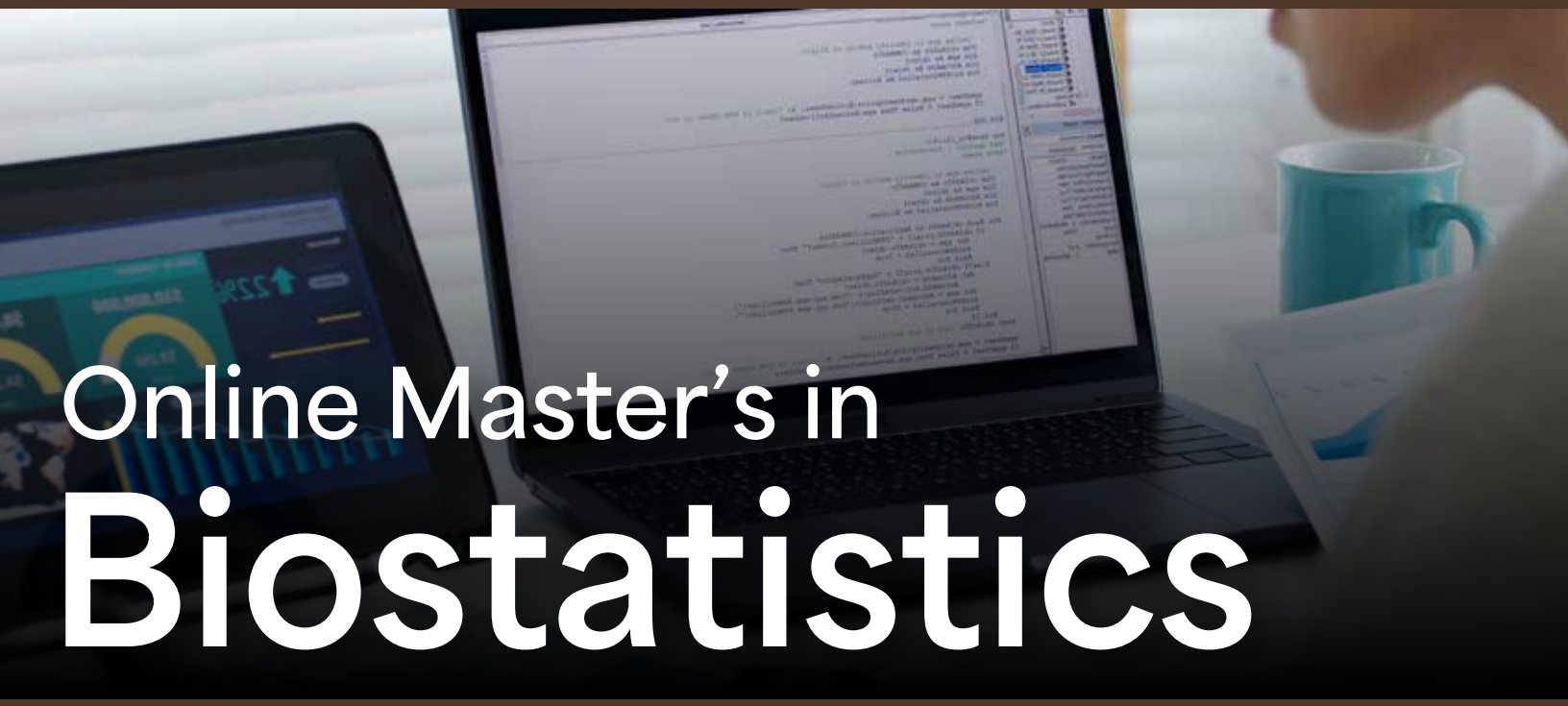
Murali Haran
Editor-in-Chief

A *JABES* Invited Session has been scheduled for the Joint Statistical Meetings in Boston in August 2026. This session will highlight the best papers published in *JABES* over the past two years. Murali Haran of Penn State University, USA, became the new Editor-in-Chief, taking over from outgoing Editor-in-Chief Jorge Mateu on 1 January 2026. Plans for *JABES* in 2026 include publishing short–non-technical or technical–editorials to foster discussion on various topics relevant to statistical methodology for agriculture, biology, and environmental sciences. Additionally, the journal will invite experts in the field to lead and contribute to one discussion paper each year. For more information on upcoming issues, the editorial board, and the aim and scope of the journal, please visit the *JABES* website.

Murali Haran
Editor-in-Chief

BROWN

All admitted students are eligible for up to 50% scholarships.



Online Master's in Biostatistics

Transform health data into impactful insights.

Brown's 20-month program, with a health data science concentration, prepares you to translate complex data into actionable insights that save lives and advance scientific understanding.

Fall 2026 Deadlines:

Early Action: March 15, 2026
Priority: May 15, 2026
Final Deadline: June 15, 2026

Scan for more info or learn more at masters.brown.edu

Editorial
UPDATES

BIOMETRICS

Geert Molenberghs
Biometrics Executive Editor

Recent papers in *Biometrics*
Papers in the December 2025 and further issues of Biometrics:
https://biometrics.biometricsociety.org/home/papers-to-appear

Among the resources available here, you will find a list of papers to appear in future issues of the Journal. You can also visit the journal via Oxford University Press: https://academic.oup.com/biometrics/issue

Many people have institutional access. However, all members have full access in the following way. Navigate to the IBS web pages at: https://www.biometricsociety.org/home. Once logged on, go to "Publications" and select "Biometrics." You will have full access to the current and preceding volumes, whether articles are Open Access or not.

In particular, we would like to draw your attention to a discussion paper, entitled "Causal inference with misspecified network interference structure," by Bar Weinstein and Daniel Nevo, and with discussions by Fei Fang and Laura Forastiere; Chan Park and Hyunseung Kang; Fredrik Sävje; Daniel Malinsky.

Submissions to the Journal

The number of submissions to *Biometrics* is at a record high. Over the last decade, we received roughly between 550 and 650 submissions a year, with the first pandemic year 2020 at a record high at the time, with 709 submissions. However, over the first eleven months of 2025 alone we are already reaching about 700 submissions. May and November 2025 saw around 75 submissions each, with also August 2025 very high (71). These are record months, not only over the last decade, but over the nearly 80 years of the journal's history!

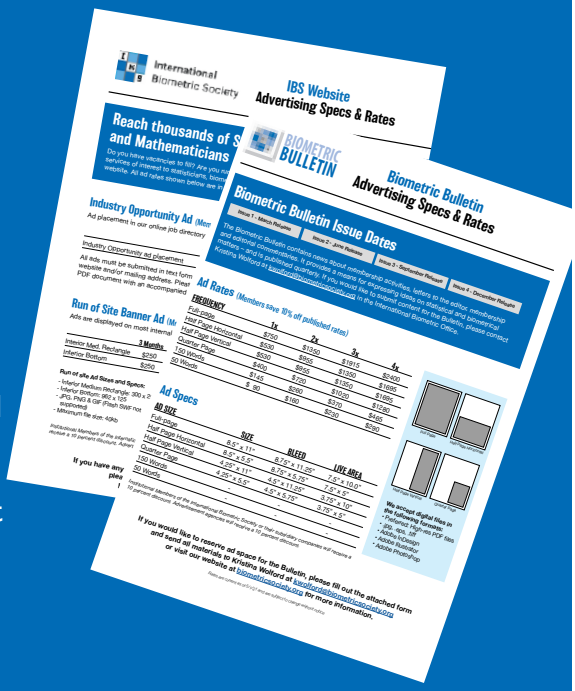
Transition Between Co-editors from Outside North America and Europe

With the year 2025 drawing to a close, Matt Schofield's (Australasian Region, New Zealand) Co-editor term is coming to an end. Matt has served as CE for the years 2023, 2024, and 2025. We wholeheartedly thank Matt for outstanding service to the journal and the Society. On January 1, 2026, Matt will hand over to Jessica Kasza (Australasian Region, Australia). Her Co-editor term runs through the end of 2028. The continuing Co-editors are Erica Moodie (ENAR, Canada, for North America until the end of 2026) and Cécile Proust-Lima (French Region, for Europe, until the end of 2027). Early in 2026, a Search Committee will be established to identify Erica Moodie's successor.

Geert Molenberghs
Biometrics Executive Editor

Advertise with Us!

Do you have vacancies to fill? Are you running a promotion, courses, selling software, or consultancy services of interest to statisticians, biometricians, and mathematicians? Consider advertising on the IBS Website and or in the Biometric Bulletin. Click below for additional information and ad rates. Please email the International Biometric Office (ibs@biometricsociety.org) with any questions. Note that exciting changes are coming to the IBS website in 2026, so we encourage you to become a part of our program now. More information is forthcoming!



Advertising Specs & Rates - 2026

This is a paid ad from StataCorp

STRengthening Analytical Thinking for Observational Studies (STRATOS): TG6 – OVERVIEW AND GUIDANCE OF PERFORMANCE MEASURES FOR CLINICAL PREDICTION MODELS

Ben Van Calster (1, 2, 3), Gary S Collins (4), Laure Wynants (1, 2, 5), Kathleen F Kerr (6), Andrew J Vickers (7), Barreñada L (1, 2), Karel GM Moons (3), David J McLernon (8), Maarten van Smeden (3), Ewout W Steyerberg (3)

(1) Department of Development and Regeneration, KU Leuven, Leuven, Belgium

(2) Leuven Unit for Health Technology Assessment Research (LUHTAR), KU Leuven, Leuven, Belgium

(3) Julius Center for Health Sciences and Primary Care, University Medical Center (UMC) Utrecht, Utrecht, Netherlands

(4) Department of Applied Health Sciences, School of Health Sciences, College and Medicine and Health, University of Birmingham, Birmingham, UK

(5) Care and Public Health Research Institute (CAPHRI), Maastricht University, Maastricht, Netherlands

(6) Department of Biostatistics, University of Washington School of Public Health, Seattle, WA, USA

(7) Department of Epidemiology and Biostatistics, Memorial Sloan Kettering Cancer Center, New York, NY, USA

(8) Institute of Applied Health Sciences, University of Aberdeen, Aberdeen, UK

With the increasing focus on machine learning algorithms, the number of risk prediction models for clinical diagnostic or prognostic outcomes is growing rapidly. Information on model performance in applied publications on clinical prediction models is chaotic with large variation in the number and selection of reported performance measures. Guidance around the relevance of available performance measures is important especially with clinical prediction models considered as medical devices. Topic group 6 from the STRATOS initiative provides a network to develop such guidance.

Together with experts from the machine learning field, we reviewed 32 key performance measures and accompanying plots [1]. This project updated an overview from 2010 that did not cover the machine learning perspective [2]. We focused on measures for prediction models with a binary diagnostic or prognostic outcome that are intended to be deployed in practice to support clinical decision-making. We illustrate claims using simulations and a case study in which the ADNEX risk model for ovarian cancer diagnosis is externally validated [3].

First, we outlined five domains of model performance under which individual measures can be classified. Discrimination addresses the extent to which the model can distinguish ('discriminate') between patients with the event and patients without the event. Calibration addresses the extent to which estimated probabilities are reliable: among individuals with an estimated probability of the event of 5%, do we observe that 5/100 have the event? Overall performance evaluates the closeness of event probabilities and event status (0 or 1). Overall performance reflects discrimination and calibration. Classification quantifies the extent to which actual

event outcomes correspond to classifications of individuals as low or high risk of the event using a probability threshold. Clinical utility assesses the extent to which these classifications may lead to better decisions. This decision-analytic performance goes beyond the other domains that focus on statistical performance.

Performance measures should exhibit two desirable characteristics: properness and focus. A proper measure yields the optimal value for the correct model, i.e. the model that yields correct probabilities conditional on the predictor variables. For focus, we consider that performance measures should either focus solely on a statistical aspect or decision-analytic performance by properly considering misclassification costs, i.e. the differential costs of a false positive (suggesting intervention in someone without the event) and a false negative (suggesting no intervention in someone with the event).

Fifteen measures violate one or both key characteristics. Thirteen of the 32 measures are improper: all 11 classification measures and 2 out of 9 overall performance measures (discrimination slope and mean absolute prediction error). Some classification measures are proper only if the probability threshold is 0.5 or equal to the event proportion, yet this is rarely a clinically relevant threshold.

Three measures have no clear focus because they poorly address misclassification costs (AUPRC or the area under the precision-recall curve, partial AUROC or the partial area under the receiver operating characteristic curve, and the F1 score). Notably, the F1 score violates both characteristics and is therefore the most misleading performance measure. This is remarkable since it is commonly reported in the machine learning literature.

In the case study, we externally validated the ADNEX model twice: the ADNEX model as is, and a recalibrated version of ADNEX. We observed that recalibration improved or did not change the value of proper measures. As expected, (semi-)proper measures whose value did not change were rank preserving measures such as AUROC. In contrast, recalibration worsened model performance for 8 of the 13 improper measures. This illustrates that improper measures can be misleading by favoring the poorer model.

For reporting, we suggest a set of measures and plots: (1) a risk distribution plot, (2) the AUROC (or the c statistic), (3) a flexible calibration plot, and (4) a clinical utility measure such as net benefit or expected cost in combination with a decision curve to evaluate model-based decision making for a range of relevant values for the differential costs of false positives and false negatives. Exception can be motivated, e.g. for the pair of sensitivity and specificity and the pair of positive predictive value and negative predictive value. These four measures are partial classification measures in that they deliberately condition on event status (sensitivity and specificity) or classification status (positive and negative predictive value). In isolation, these four measures are improper, but they may be valuable to report descriptively in pairs: sensitivity and specificity together, and/or positive and negative predictive value together.

We hope that focusing on a core set of informative performance measures with desirable characteristics will streamline reporting of clinical prediction models, thereby reducing arbitrariness and deception.

References

1. Van Calster B, Collins GS, Vickers AJ, Wynants L, Kerr KF, Barreñada L, Varoquaux G, Singh K, Moons KGM, Hernandez-Boussard T, Timmerman D, McLernon DJ, van Smeden M, Steyerberg EW. Evaluation of performance measures in predictive artificial intelligence models to support medical decisions: overview and guidance. Lancet Digital Health 2025;7:100916. doi 10.1016/ j.landig.2025.100916.

2. Steyerberg EW, Vickers AJ, Cook NR, Gerds T, Gonen M, Obuchowski N, Pencina MJ, Kattan MW. Assessing the performance of prediction models: a framework for traditional and novel measures. Epidemiology 2010;21:128-138. doi 10.1097/ EDE.0b013e3181c30fb2.

3. Landolfo C, Ceusters J, Valentin L, Froyman W, Van Gorp T, Heremans R, Baert T, Wouters R, Vankerckhoven A, Van Rompuy AS, Billen J, Moro F, Mascilini F, Neumann A, Van Holsbeke C, Chiappa V, Bourne T, Fischerova D, Testa A, Coosemans A, Timmerman D, Van Calster B. Comparison of the ADNEX and ROMA risk prediction models for the diagnosis of ovarian cancer: a multicentre external validation in patients who underwent surgery. Br J Cancer 2024;130:934-940. doi 10.1038/s41416-024-02578-x.

Table. Recommendations and remarks for different measures and plots in the context of validating a prediction model to support clinical decision making. Reproduced with minor technical or grammatical adaptations from [1] (CC-BY license), no changes to the contents or recommendations were made.

Measure / Plot	Recommendation	Remark
DISCRIMINATION		
AUROC	Recommended	This measure quantifies discrimination, which is a key component of statistical model performance.
AUPRC and pAUROC	Inadvisable	These measures attempt to move beyond a statistical assessment but violate decision-analytic principles.
ROC curve and PR curve	Neither inadvisable nor essential	These plots provide limited additional information over AUROC.
CALIBRATION		
O:E ratio	Neither inadvisable nor essential	This measure is interpretable but provides only a partial assessment of calibration; O:E ratio is often 1 or close to 1 during internal validation.
Calibration intercept and calibration slope	Neither inadvisable nor essential	These measures are hard to interpret and provide a partial assessment of calibration; for internal validation, quantifying calibration slope can be used to gauge overfitting (a need for 'shrinkage').
ECI, ICI, and ECE	Neither inadvisable nor essential	These measures summarize calibration plots, concealing the nature and direction of miscalibration, and struggle with statistical consistency.
Calibration plot (or reliability diagram)	Recommended	The most insightful approach to assess calibration, in particular when smoothing is used rather than grouping; for internal validation, reporting only the calibration slope is acceptable; for external validation, a calibration plot is strongly recommended, with indications of uncertainty (e.g. 95% confidence intervals).
OVERALL PERFORMANCE		
Loglikelihood, Brier, and R-squared measures (McFadden, Cox-Snell, Nagelkerke)	Neither inadvisable nor essential	We advise to evaluate discrimination and calibration separately. These measures are more relevant for model selection tasks, which are beyond the scope of this work.
Discrimination slope and MAPE	Inadvisable	These measures are improper; i.e. values can be better for incorrect models than for the correct model.
Risk distribution plots	Recommended	Displaying the distribution of the risk estimates for each outcome category provides valuable insights into a model's behavior.
CLASSIFICATION		
Classification accuracy, balanced accuracy, Youden index, DOR, kappa, F1, and MCC	Inadvisable	These measures are improper at clinically relevant decision thresholds; in addition, some measures are hard to interpret.
Sensitivity (or recall) and specificity	Not essential; can be descriptive if reported together	Although improper on their own, they can be reported descriptively if reported together. However, these measures are theoretical as they condition on the outcome.
PPV (or precision) and NPV	Not essential; can be descriptive if reported together	Although improper on their own, they can be reported descriptively if reported together. PPV and NPV are practical measures because they condition on the classification.
Classification plot	Neither inadvisable nor essential	Classification plots plot could be presented descriptively, showing either sensitivity and specificity or PPV and NPV by threshold.
CLINICAL UTILITY		
NB, standardized NB, or EC (with a decision curve)	Recommended	Important measures to quantify to what extent better decisions can be made with support of the model. Decision curves of NB allow one to show potential clinical utility at various clinically relevant decision thresholds relative to default decisions (and competing models).

AUROC, area under the receiver operating characteristic (ROC) curve; AUPRC, area under the precision-recall (PR) curve; pAUROC, partial AUROC; ; ECI, estimated calibration index; ICI, integrated calibration index; ECE, expected calibration error; R2, R-squared; MAPE, mean absolute prediction error; DOR, diagnostic odds ratio; MCC, Matthew's correlation coefficient; PPV, positive predictive value; NPV, negative predictive value; NB, net benefit; EC, expected cost.

Contributed COMMENTARY

Advancing Biostatistics Education in Spain: Current Challenges and a Roadmap for the Future

Miguel Angel Luque Fernández (1, mluquefe@ugr.es), Miguel Angel Montero Alonso (1), Pedro Femia Marzo (1), Juan Manuel Melchor Rodríguez (1), Pedro Carmona Sáez (1, 2), Manuela Expósito Ruiz (1)

(1) Department of Statistics and Operations Research, Faculty of Sciences, University of Granada, Granada, Spain

(2) Bioinformatics and Health Data Science Group, Center for Genomics and Oncological Research, University of Granada, Granada, Spain

Introduction

The biostatistics curriculum in Spanish universities faces several challenges, particularly in terms of the limited number of universities offering it as an undergraduate or postgraduate program, including applied and practical training and education (1). A critical distinction must be made between undergraduate teaching—where biostatistics is typically limited to a few courses within other degrees—and master's and proprietary programs (títulos propios), which offer a more structured curriculum. This lack of hands-on experience and applied educational focus determines how well students are prepared for real-world applications (1). Most programs lean heavily on theory, leaving graduates without the practical and computational skills needed for clinical, epidemiological, and public health work (1). In fact, the Spanish education system has long been criticized for being mostly theoretical and "deficient in applied mathematics, including biostatistics" (1). This gap means students often struggle to use statistical tools effectively in real-life scenarios (1).

Current Issues

Another issue is the limited integration of practical work and an applied perspective that reflects current research and clinical needs (1). This specialized postgraduate education is geographically scarce, with official master's degrees concentrated in Madrid, Catalonia, and the Valencian Community, leaving vast regions of Spain unprovided with specialized academic offerings. Regarding curriculum, the available official programs exhibit significant heterogeneity in structure and focus. For instance, programs range from 60 to 90 ECTS, reflecting a diversity in specialization but a lack of curriculum homogeneity nationally. Advanced biostatistics programs often expect students to have experience with clinical trials, but this training isn't consistently offered (1). Admission requirements often focus on theoretical knowledge rather than practical experience, so graduates may understand biostatistical principles but cannot apply them in areas like epidemiology or clinical research (1). This discussion is highly relevant in understanding the lack of professionals and its potential causes (1).

An excellent example of a national strategy to overcome this challenge is the Biostatistical Collaboration of Australia (BCA). The BCA is a national consortium established by Australian universities, government, and industry experts to address a critical shortage of professional biostatisticians (2). Its primary utility is to develop and deliver a standardized, high-quality, distance-learning program allowing students to enrol in a host university while receiving instruction from specialists across the collaborative network (2). This alliance ensures a robust, mathematically grounded curriculum focused on health applications, and its accreditation by the Statistical Society of Australia guarantees that graduates meet professional standards (2).

Systemic Challenges

Funding for education and research is limited, and training during undergraduate and residency programs is often inadequate (1). These barriers make it harder to prepare students for the demands of modern healthcare (1). On top of that, the use of practical tools and software in the curriculum varies across different degrees and institutions (1). While some programs teach basic tools for data analysis, this isn't widespread, leaving students with minimal exposure to essential biostatistical methods (1).

Furthermore, a critical systemic challenge is the lack of an official collegiate body for biostatisticians in Spain (1). The landscape of biostatistics in Spain is supported by organizations such as Biostatnet (3), a prominent thematic network that facilitates national and international collaboration and resource sharing among researchers across various regions. Additionally, the field is represented by the Spanish Society of Biostatistics (SEB) (4), the national branch of the International Biometric Society. While other groups like the Spanish Association of Statistics for Health (AESA) historically advocated for the profession, they are no longer active, leaving a current gap in official collegiate representation. In other fields, like medicine and engineering, advisory legal and professional bodies provide a support structure. There have been historical attempts to constitute such a body—reflecting long-standing professional demands—but the current absence of such an organization leaves biostatistics professionals without a formal support structure (1).

A Broader Context: Strengths and Future Directions

The current assessment of challenges must be balanced by highlighting existing strengths and opportunities in the field:

1. International Network: Initiatives like Biostatnet facilitate national and international collaboration and resource sharing (3).
2. Academic Alliances: European alliances for master's studies, such as Erasmus Mundus Joint Masters, offer competitive scholarships and joint degrees across multiple partner universities.
3. Institutional Cooperation: The European Universities Initiative fosters deep cooperation among institutional alliances to streamline curriculum development and ensure automatic recognition of qualifications.
4. Active Alliances: As of mid-2024, there are 64 active European University Alliances with over 560 higher education institutions, including the 4EU+ Alliance, Arqus, and Una Europa (1).

Looking ahead, the future of national biostatistics should capitalize on the powerful synergy between biomathematics and bioinformatics, both of which are integrated under the framework of health data science. Biomathematics, which traces its roots to the work of Alan Turing and his seminal theories on pattern formation (5), is a branch of applied mathematics that converges with biostatistics and offers a tremendously open field for theoretical innovation. Bioinformatics focuses on the acquisition, storage, and analysis of biological data, providing the computational infrastructure and algorithmic depth necessary to handle increasingly complex datasets. Together, these disciplines form a cohesive ecosystem within health data science: while biomathematics provides the theoretical models to understand biological mechanisms and biostatistics ensures the rigorous validation of findings, bioinformatics offers the tools to process high-dimensional information.

Recommendations

To address these issues, Spanish universities should continue shifting toward a more applied approach, emphasizing practical training and modern computational tools such as GitHub, Python, and artificial intelligence. Ideas based on successful programs elsewhere include:

1. Professional Certificate Programs: Create online certificate programs that teach biostatistics for medical research.
2. Short Practical Courses: Offer intensive minicourses on applied biostatistics and tools like R, tailored to fields such as genomics.
3. Clinical Data Analysis Training: Develop programs focused on clinical data using multiple statistical software tools like SAS, Stata, Python, Julia, and R.
4. Applied Biostatistics Certificates: Create pathways for health professionals who lack formal biostatistics training to upskill.
5. Experiential Workshops: Organize interactive workshops using real-life case studies to bridge theory and practice.

Barriers

Implementing these changes involves navigating several barriers identified in national and global assessments (1, 6): i) Limited Funding: Only a small fraction of national grants goes to biostatistics, restricting resources for applied training (1). ii) Instructional Focus: Many educators have limited practical experience, which can make the curriculum more theoretical than applied (6). iii) Pedagogical Trends: In some cases, traditional teaching methods are still favored over hands-on approaches, slowing the adoption of modern computational tools (6). iv) Curricular Adaptation: Current programs do not always adapt quickly to the rapidly evolving technological and data-driven needs of modern healthcare (1).

Conclusion

To overcome these challenges, universities should advocate for increased funding, invest in teacher training, and continue reforming curricula to incorporate internships, case studies, and collaborations with health organizations. Furthermore, establishing a collegiate body remains an essential goal for professional support and guidance. These steps would make biostatistics education even more practical, relevant, and impactful in Spain.

References

1. Luque-Fernández MÁ, Negro Calduch E. Education in public health, epidemiology and biostatistics in Spain from a global and comparative perspective. Gac Sanit. 2019;33(6):502–3.
2. Biostatistics Collaboration of Australia. What is the Biostatistics Collaboration of Australia (BCA)? [Internet]. BCA; [cited 2025 Dec 4]. Available from: https://www.bca.edu.au/about-bca/
3. Biostatnet. Red Nacional de Bioestadística [Internet]. Santiago de Compostela: Biostatnet; [cited 2026 Jan 7]. Available from: https://biostatnet.com/
4. Sociedad Española de Bioestadística. Spanish Region of the International Biometric Society [Internet]. Valencia: SEB; [cited 2026 Jan 7]. Available from: http://www.biometricsociety.net/
5. Turing AM. The chemical basis of morphogenesis. Phil Trans R Soc Lond B. 1952;237(641):37–72.
6. Horton NJ, Hardin JS. Teaching the Next Generation of Statistics Students to "Think with Data": Special Issue on Fundamental Concepts in Data Science. J Stat Educ. 2015;23(3).

Software CORNER

RobinCar2: ROBust INference for Covariate Adjustment in Randomized Clinical Trials

Dong Xi[1], Marlena Bannick[2], Gregory Chen[3], Liming Li[4], Daniel Sabanés Bové[5], Ting Ye[2], Yanyao Yi[6]
[1]Gilead Sciences, [2]University of Washington, [3]MSD, [4]AstraZeneca,
[5]RCONIS, [6]Eli Lilly and Company

March 05, 2026

1 Introduction

Covariate adjustment is a powerful statistical technique that can increase efficiency in randomized clinical trials (RCTs) by reducing variability in treatment effect estimates. The U.S. Food and Drug Administration (FDA) finalized the guideline on covariate adjustment, providing recommendations and best practices for using these methods in drug development (FDA, 2023). However, a gap has existed between the extensive statistical literature on covariate adjustment and software that is easy to use and follows these best practices.

The **RobinCar2** R package, which stands for **ROB**ust **IN**ference for **C**ovariate **A**djustment in **R**andomized clinical trials, addresses this gap. It is a streamlined version of the original **RobinCar** package (Bannick et al., 2026a), designed with minimal dependencies and extensive validation for use in drug development, particularly for Good Practice (GxP) purposes. The package is supported by the ASA Biopharmaceutical Section Covariate Adjustment Scientific Working Group Software Subteam.

This paper provides an introduction to **RobinCar2**, covering its core functionality for three common outcome types in clinical trials: continuous, binary, and time-to-event outcomes. It also provides best practices of using **RobinCar** and **RobinCar2** packages for covariate adjustment.

2 Covariate Adjustment in RCTs

Covariate adjustment leverages baseline variables to improve the precision of treatment effect estimates. Unlike traditional regression interpretations, covariate-adjusted estimators in RCTs target the same unconditional (marginal) treatment effect as unadjusted analyses, but with potentially smaller variance. This is because randomization ensures treatment assignment is independent of baseline covariates, allowing model-assisted approaches that are robust to model misspecification.

RobinCar2 supports three covariate-adaptive randomization schemes:

- Simple randomization `(sr)`: Subjects are randomly assigned to treatment groups without stratification.
- Permuted-block randomization `(pb)`: Treatment assignments are balanced within blocks defined by stratification factors.
- Pocock-Simon minimization `(ps)`: An adaptive method that minimizes imbalance across multiple stratification factors.

The package provides two variance estimation approaches:

- `vcovG`: The default heteroskedasticity-consistent variance estimator that accounts for covariate-adaptive randomization.
- `vcovHC`: The Huber-White sandwich estimator, which is appropriate for linear covariate adjustment and only when treatment-by-covariate interactions are not included in the model.

3 Analysis of Continuous Outcomes

For continuous outcomes, **RobinCar2** provides the `robin_lm()` function, which fits a linear model and returns covariate-adjusted treatment effect estimates with robust inference. The following code fits an ANHECOVA (Analysis of Heterogeneous Covariance) model (Ye et al., 2023a), which includes the treatment assignment `(treatment)`, the stratification factor `(s1)`, the treatment-by-stratification interaction `(treatment * s1)`, and a continuous covariate `(covar)`. The randomization scheme is permuted-block randomization stratified by `s1`, specified as `treatment ~ pb(s1)`. The variance estimation method is `vcovG`.

```r
library(RobinCar2)

result_lm <- robin_lm(
  y ~ treatment * s1 + covar,
  data = glm_data,
  treatment = treatment ~ pb(s1),
  vcov = "vcovG"
)

print(result_lm)
```

```
## Model       :  y ~ treatment * s1 + covar
## Randomization:  treatment ~ pb(s1)  ( Permuted-Block )
## Variance Type:  vcovG
## Marginal Mean:
##      Estimate  Std.Err    2.5 % 97.5 %
## pbo  0.200321 0.067690 0.067651 0.3330
## trt1 0.763971 0.075929 0.615152 0.9128
## trt2 0.971250 0.076543 0.821228 1.1213
##
## Contrast     :  h_diff
##               Estimate Std.Err Z Value  Pr(>|z|)
## trt1 v.s. pbo   0.56365 0.10074  5.5952 2.203e-08 ***
## trt2 v.s. pbo   0.77093 0.10133  7.6082 2.779e-14 ***
## trt2 v.s. trt1  0.20728 0.10683  1.9402   0.05235 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

The output has three main parts. The first part reiterates the input parameters and the model specification. The second part provides results on **Marginal Mean**, which includes estimated response means for each treatment group with standard errors and confidence intervals. The last part provides the **Contrast** results, including pairwise treatment comparisons (the difference in means) with test statistics and p-values. The Huber-White variance estimator can be applied when the linear model does not include treatment-by-stratification/covariate interactions, by specifying `vcov = "vcovHC"` (Rosenblum and van der Laan, 2009; Lin, 2013). The confidence interval of treatment effect contrasts can be obtained via the `confint()` function.

4 Analysis of Binary and Count Outcomes

For binary and count outcomes, **RobinCar2** provides `robin_glm()`, which extends the framework to generalized linear models (Ye et al., 2023b, Bannick et al. 2025). The following code fits a logistic model `(family = binomial(link = "logit"))`, which includes the `treatment` assignment `(treatment)`, the stratification factor `(s1)`, the treatment-by-stratification interaction `(treatment * s1)`, and a continuous covariate `(covar)`. The randomization scheme is permuted-block randomization stratified by `s1`, specified as `treatment ~ pb(s1)`. Currently, `vcovG` is the only supported method for variance estimation in generalized linear models.

```r
result_binary <- robin_glm(
  y_b ~ treatment * s1 + covar,
  data = glm_data,
  treatment = treatment ~ pb(s1),
  family = binomial(link = "logit"),
  contrast = "difference"
)

print(result_binary)
```

```
## Model       :  y_b ~ treatment * s1 + covar
## Randomization:  treatment ~ pb(s1)  ( Permuted-Block )
## Variance Type:  vcovG
## Marginal Mean:
##      Estimate  Std.Err    2.5 % 97.5 %
## pbo  0.356097 0.033599 0.290243 0.4219
## trt1 0.580696 0.034418 0.513238 0.6482
## trt2 0.621386 0.034019 0.554711 0.6881
##
## Contrast     :  difference
##               Estimate  Std.Err Z Value  Pr(>|z|)
## trt1 v.s. pbo  0.224599 0.047711  4.7075 2.508e-06 ***
## trt2 v.s. pbo  0.265290 0.047534  5.5818 2.391e-08 ***
## trt2 v.s. trt1 0.040691 0.047941  0.8488     0.396
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

The output of `robin_glm()` has a similar structure to `robin_lm()`. The default contrast for binary outcomes is the difference in probabilities `(contrast = "difference")`. **RobinCar2** supports other contrast functions, including risk ratio, odds ratio, and their log transformations `("log_risk_ratio", "log_odds_ratio")`. The confidence interval of treatment effect contrasts can be obtained via the `confint()` function. Any family argument handled by `glm()` can be used with `robin_glm()`.

5 Analysis of Time-to-Event Outcomes

For survival outcomes, **RobinCar2** provides `robin_surv()`, which implements stratified and covariate-adjusted log-rank tests and hazard ratio estimation (Ye et al., 2024). The following code fits a stratified log-rank test and estimates hazard ratios, stratified by the factor `strata`. The treatment variable `(sex)` is specified via the `treatment` formula. The randomization scheme is permuted-block randomization stratified by `strata`, specified as `sex ~ pb(strata)`.

```r
result_tte <- robin_surv(
  Surv(time, status) ~ 1 + strata(strata),
  data = surv_data,
  treatment = sex ~ pb(strata)
)

print(result_tte)
```

```
## Model        : Surv(time, status) ~ 1 + strata(strata)
## Randomization: sex ~ pb(strata) (Permuted-Block)
## Stratification variables:  strata
##
## Contrast     : Stratified Log Hazard Ratio
##
##                 Estimate Std.Err Z Value Pr(>|z|)
## Male v.s. Female  0.55482 0.17063  3.2516 0.001147 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Test         : Stratified Log-Rank
##
##                  Test Stat. Pr(>|z|)
## Male v.s. Female     3.2856 0.001018 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

The output of `robin_surv()` has a similar structure to `robin_lm()` and `robin_glm()`. The **Contrast** section provides unconditional (marginal) hazard ratios for all pairwise treatment comparisons. The **Test** section provides the log-rank test results. The confidence interval of hazard ratios can be obtained via the `confint()` function.

6 Best Practices of using RobinCar and RobinCar2

RobinCar2 is a streamlined version of the original **RobinCar** package with the following characteristics (Bannick et al., 2026b):

Feature	RobinCar	RobinCar2
Dependencies	More extensive	Minimal
Validation	Standard	GxP-ready
Methods	Comprehensive	Curated subset
Support	Research community	ASA BIOP Covariate Adjustment Working Group

Methods included in **RobinCar2** have undergone additional validation and are recommended for interactions with regulatory agencies. Previous users of **RobinCar** should therefore consider transitioning to **RobinCar2** when possible.

7 Conclusions

RobinCar2 provides a validated, user-friendly implementation of covariate adjustment methods for randomized clinical trials. Its simple interface, based on familiar R formula syntax, makes it accessible to clinical trial statisticians while ensuring robust inference aligned with the FDA guideline. The package covers the most common outcome types encountered in clinical trials: continuous, binary, and time-to-event outcomes. Future development of **RobinCar2** may include additional variance estimation methods, the Mantel-Haenszel risk difference estimator (currently available in **RobinCar**), and bootstrap methods.

For more information, including additional vignettes and documentation, visit the package GitHub repository at github.com/openpharma/RobinCar2

8 Acknowledgements

This package is supported by ASA Biopharmaceutical Section Covariate Adjustment Scientific Working Group Software Subteam.

9 References

Bannick M, Shao J, Liu J, Du Y, Yi Y, Ye T (2025). A General Form of Covariate Adjustment in Randomized Clinical Trials. *Biometrika*, 112(3) asaf029.

Bannick M, Qian Y, Ye T, Yi Y, Bian F (2026a). RobinCar: Robust Inference for Covariate Adjustment in Randomized Clinical Trials. R package version 1.1.0, https://CRAN.R-project.org/package=RobinCar.

Bannick M, Bian Y, Chen G, Li L, Qian Y, Sabanés Bové D, Xi D, Ye T, Yi Y (2026b). The RobinCar Family: R Tools for Robust Covariate Adjustment in Randomized Clinical Trials. *arXiv preprint*, arXiv:2601.14498.

Food and Drug Administration (2023). Adjusting for Covariates in Randomized Clinical Trials for Drugs and Biological Products: Final Guidance for Industry, https://www.fda.gov/media/148910/download.

Lin W (2013). Agnostic Notes on Regression Adjustments to Experimental Data: Reexamining Freedman's Critique. *Annals of Applied Statistics*, 7(1):295-318.

Rosenblum M, van der Laan MJ (2009). Using Regression Models to Analyze Randomized Trials: Asymptotically Valid Hypothesis Tests Despite Incorrectly Specified Models. *Biometrics*, 65(3):937-945.

Ye T, Shao J, Yi Y, Zhao Q (2023a). Toward Better Practice of Covariate Adjustment in Analyzing Randomized Clinical Trials. *Journal of the American Statistical Association*, 118(544):2370-2381.

Ye T, Bannick M, Yi Y, Shao J (2023b). Robust Variance Estimation for Covariate-Adjusted Unconditional Treatment Effect in Randomized Clinical Trials with Binary Outcomes. *Statistical Theory and Related Fields,* 7(2):159-163.

Ye T, Shao J, Yi Y (2024). Covariate-Adjusted Log-Rank Test: Guaranteed Efficiency Gain and Universal Applicability. *Biometrika*, 111(2):691-705.

Regional NEWS

Central American and Caribbean (RCAC)

The International Biometric Society (IBS) Central American and Caribbean (RCAC) Region has been active in this quarter with many of its members having achieved publications. Prof Oscar Espinoza has co-authored an editorial on the impact of changes in NICE guidelines; a study on temporal dynamics of annual expenditures and frequency of use of medical imaging; a cost-utility analysis of expanding subsidized health care to Venezuelan migrants; and a study on mental health spending in Colombia. Dr. Michelle Guevara-Nieto saw the publication of his research paper on identifying predictive biomarkers for neoadjuvant chemotherapy response.

And, Vrijesh Tripathi published a research paper on optimizing breast cancer prediction. The details of all papers are provided below for larger dissemination. The following publications have been made by members of IBS RCAC:

- Vallejo-Torres, L., Edney, L., Espinosa, O., Karnon, J., Longo, F., Paulden, M., Howdon, D., & Vanness, D. (2026). Politicised changes to the NICE threshold risk making cost-effectiveness analysis performative, not informative. Applied Health Economics and Health Policy. https://doi.org/10.1007/s40258-025-01026-y
- Espinosa, O., Puentes, G., Bejarano, V., Romero, J, Arias, L., Hedgire, S., Daye, D., Mohan, S., & Duszak, R. (2025). Expenditure and use on radiology imaging in urban and rural areas in a developing country. Cost Effectiveness and Resource Allocation. 23, 74. https://doi.org/10.1186/s12962-025-00681-1
- Espinosa, O., Rodríguez, P., Bejarano, V., León, S., & Ortiz, J. (2025). Health for all? A cost-utility evaluation of Colombia's policy to enroll Venezuelan migrants (2021–2023). Journal of Migration and Health, 12, 100374. https://doi.org/10.1016/j.jmh.2025.100374
- Espinosa, O., Bejarano, V., Mejía, A., Arias, L., Vargas-Gonzalez, J., & Sanchez-Pedraza, T.(2025). Mental health spending in Colombia: an analysis of rural and urban areas. Annals of General Psychiatry, 24, 54. https://doi.org/10.1186/s12991-025-00589-3
- Guevara-Nieto, H.M., Parra-Medina, R., Orozco, C.A. et al. Identification of predictive pretreatment biomarkers for neoadjuvant chemotherapy response in Latino invasive breast cancer patients. Mol Med 31, 335 (2025). https://doi.org/10.1186/s10020-025-01338-8
- Sampson, A., James, A. & Tripathi, V. Optimizing breast cancer prediction through stacking ensemble machine learning models: a comparative analysis. Journal of Electrical Systems and Inf Technol 13, 9 (2026). https://doi.org/10.1186/s43067-025-00313-x

Vrijesh Tripathi, PhD
Biometric Bulletin Correspondent

China (CHINA)

The 8th Pacific Causal Inference Conference (PCIC 2026) will be held in Tianjin, China, from 18-19 July 2026. The PCIC has become an annual academic event in the causal science community since 2019. PCIC 2026 will bring together leading experts and scholars in the causal inference community to facilitate cross-disciplinary collaboration, advance theoretical research, and drive innovative applications across industries. The conference includes one short course on causal inference, entitled "From Statistical Foundations to AI Era," and invited talks on a range of topics related to causal inference. We warmly invite experts and scholars from around the world to join PCIC 2026 and contribute to the advancement of the field of causal inference. Register for the conference here.

To register for the Short Course, please visit the following registration link: https://www.meta-conference.cc/index/index/login/id/89.html

For more details about the conference, please visit Website.

We look forward to seeing you in Tianjin, China.
The PCIC Program Committee

Dr. Xing Zhao
Biometric Bulletin Correspondent

Eastern Mediterranean Region (EMR)

38th Panhellenic & 4th International Statistics Conference (ESI 2026)

The 38th Panhellenic and 4th International Statistics Conference is scheduled to take place from 16 - 19 April 2026, at the Aristotle University of Thessaloniki (AUTh), Greece. Organized by the Greek Statistical Institute (ESI) in collaboration with the Departments of Informatics and Mathematics at AUTh. This event brings together a diverse community of statisticians, mathematicians, data analysts, and researchers to explore cutting-edge developments in probability theory, machine learning, and biostatistics. The program features a comprehensive range of topics, from actuarial science and risk management to medical and social statistics, aiming to bridge theoretical advancements with practical applications in modern industry and administration.

Necla Kochan
Biometric Bulletin Correspondent

French (FR)

The French Region of the IBS (Société Française de Biométrie, SFB) held its annual general meeting virtually 15 January 2025 at 3 pm CET. Three new members have been approved to join the executive committee. A call for applications was launched to succeed Anne Thiébaut (Inserm, Villejuif) as the region correspondent for the *Biometric Bulletin*. The French Region is pleased to welcome Emeline Courtois (Univ Paris-Saclay, Villejuif) as the new *Biometric Bulletin* correspondent.

Upcoming events include:

- A dedicated Channel Network session during the 33rd International Biometric Conference in Seoul in partnership with the IBS regions of Belgium, Great Britain/Ireland, and the Netherlands;
- The biennial Daniel Schwartz dissertation prize, which rewards one or two theses in biometrics defended between July 2024 and June 2026, to be awarded during the Young Researchers Day of the French IBS region in early 2027;
- The 11th Channel Network Conference (CNC), in partnership with the IBS regions of Belgium, Great Britain/Ireland, and the Netherlands, to be held in Rennes (western France) in 2027;
- The French Region will participate in organising the 34th International Biometric Conference in Basel (Switzerland) in partnership with the Austrian-Swiss and German regions of the IBS.

More information can be found on the Website of the French Region.

Anne Thiebaut
Biometric Bulletin Correspondent

German (DR)

Health Technology Assessment for Statisticians
The APF Autumn Workshop 2025 took place in Munich on 28 November 2025 (with an informal get-together on 27 November). The meeting, organized by Metronomia, focused on "Bridging Development and EU HTA: Insights for Statisticians;" and brought together around 150 participants to discuss practical implications of the evolving European Union HTA landscape for evidence generation and trial design.

The morning session covered policy estimands and authority interactions, an overview of the EU HTA process, strategic planning for EU-HTA including trial design and JCA dossier development, and a data-to-dossier perspective on evidence generation. A report from the European Commission's stakeholder workshop and a panel discussion rounded out the session. In the afternoon, updates from APF working groups were followed by talks on managing the evidence generation gap (EGAP), assessing evidence generation and ITC feasibility for EU-HTA, and surrogate endpoint validation within the JCA guidance framework, concluding with a final discussion and networking.

The annual Stats Leaders Meeting the day before the APF workshop brought together leaders from pharma, CROs and academia to strengthen collaboration in statistics and data science. The discussion began with sponsor-CRO responsibilities in planning and delivering statistical analyses. It then shifted to practical ways to intensify academia-industry collaboration, from thesis projects to research and doctoral partnerships, complemented by brief spotlights on relevant study programs at several universities. Breakout sessions translated ideas into action, covering desired curriculum topics, internship structures, and collaboration models such as joint supervision theses, workshops/guest lectures, and joint research initiatives.

Looking ahead, our annual APF workshop will take place on 27 November 2026 in Stuttgart. Many thanks to Elderbrook Solutions GmbH and Michaela Kohring for hosting.

–Hannes Buchner

Non-Clinical Statistics

The Non-Clinical Statistics working group of the German Region of the IBS and the DFG Research Training Group 2624 "Biostatistical methods for high-dimensional data in toxicology" held a joint workshop at TU Dortmund on December 11 and 12, 2025. The event was organized by the chairs of the working group, Bernd-Wolfgang Igl (Boehringer Ingelheim, Biberach) and Frank Konietschke (Charité, Berlin), as well as by the spokesperson of the RTG, Jörg Rahnenführer (TU Dortmund University).

The program covered a wide range of interesting topics including statistical strategies in toxicology, analysis of historical and virtual control groups, statistical aspects of experimental design, translational sciences, alternatives to animal testing, dose-response analysis, artificial intelligence in preclinical data analysis incl. a corresponding panel discussion, and many more.

Participants of the Non-Clinical Statistics meeting at Dortmund

Upcoming Meetings

18-21 May 2026, at Warsaw (Poland)
72nd Biometric Colloquium as part of the 6th Conference of the Central European Network: "Power of Data – Shaping the Future of Life Sciences"
cen2026.org

2-3 June 2026, in Newcastle (UK)
Workshop of working group Adaptive Designs and Multiple Testing Procedures. **Abstracts due 31 January 2026. Registration starts 5 January 2026.**

1 June 2026
Half-day courses "Practitioner's View of Adaptive Designs" and "Designing better trials: Advanced randomization methods for modern clinical research"

23-26 June 2026
Summer School 2026 "Surrogate Endpoint Evaluation in Clinical Trials." With Geert Molenberghs (Hasselt & Leuven), Ariel Alonso (Leuven) and Wim Van der Elst (J&J).
Registration before 1 February 2026.
Flyer

27 November 2026, at Stuttgart
20-24 March 2028, at Bremen
74th Biometric Colloquium as part of the DAGStat Conference
Location: Bremen

Reinhard Vonthein
Biometric Bulletin Correspondent

Japan (JR)

The 2025 Biometric Seminar
The Biometric Seminar entitled "Current status and statistical considerations in regenerative medicine and small-sample clinical trials" and "Theory and applications of high-dimensional data analysis" was held on 12 December 2025, both on-site at Chuo University and online. The lectures covered a wide range of topics, ranging from statistical issues arising in regenerative medicine and small-sample trials, such as study design and regulatory evaluation, to recent methodological advances in high-dimensional data analysis, particularly sparse modeling and estimation techniques.

The 2026 Annual Meeting of the Biometric Society of Japan
The 2026 Annual Meeting of the Biometric Society of Japan (BSJ) will be held on 15-16 May 2026 at Matsue Terrsa, Shimane, Japan. An invited session and a tutorial session will be organized.

Meetings:

15-16 May 2026
The 2026 Annual Meeting of the Biometric Society of Japan
Matsue Terrsa, Shimane, Japan

Masataka Taguri
Biometric Bulletin Correspondent

Spanish (REsp)

8th SEB Student Conference of the Spanish Region of the IBS (SEB)

The 8th SEB Student Conference of the Spanish Region of the IBS (SEB) was held from January 28 to 30 2026 in Bilbao, bringing together more than 45 students and early-career researchers. Over the three days, 39 scientific contributions were presented, including 32 oral presentations and 7 posters, highlighting the diversity and vitality of current research in biometry and statistics.

The program featured 8 oral sessions and one poster session, covering a wide range of topics. In addition, participants attended a short course delivered by Dr. Lore Zumeta Olaskoaga (Biogipuzkoa and University of Deusto), entitled "Pain, Points, and p-values: A Hands-On Introduction to Sports Injury Biostatistics," which provided an accessible introduction to statistical methods in sports injury research. The conference also included a round table discussion focused on interdisciplinary statistical communication, offering an open exchange of perspectives on how statisticians and researchers from other fields can work together more effectively.

Group photo of the conference attendees

Ester Boixadera
Biometric Bulletin Correspondent

Western North America (WNAR)

2026 WNAR Election Results

Thank you to everyone who participated in the WNAR election for 2026 positions. Congratulations to WNAR President-Elect Gang Li, Representatives-at-Large Mary Sammel and Brian David Williamson, Program Coordinator Mi-Ok Kim, and Treasurer Brandie Wagner.

Special thanks go to outgoing WNAR Past-President Megan Othus, outgoing Representatives-at-Large Natalie Gasca and Yu-Ru Su, outgoing Regional Advisory Board members Carsten Goerg, Mary Sammel, Lisa Kanary, and Ted Lystig, and outgoing IBS Council Representatives Miguel Marino and Lang Wu. We are grateful for their efforts and dedication to WNAR.

We would like to thank all the WNAR members who volunteered to be candidates for these offices. WNAR is fortunate to have so many talented members willing to dedicate their time and energy to WNAR, which makes each election a choice among outstanding individuals.

2026 WNAR/IMS Meeting

The 2026 WNAR/IMS meeting will be in Pullman, WA, at Washington State University from 14-17 June 2026.

Washington State University in Pullman offers a beautiful summer setting for a conference, combining the energy of a vibrant campus with the charm of the surrounding Palouse region. Warm, sunny days highlight the rolling hills of wheat fields that create one of the most picturesque landscapes in the Pacific Northwest. Attendees can enjoy strolls through WSU's scenic campus, visit the renowned Bear Center or the Jordan Schnitzer Museum of Art, and experience the lively downtown Pullman with its local shops and eateries. Just beyond Pullman, opportunities abound for outdoor recreation, from hiking and biking trails to nearby rivers and lakes, making it an ideal destination where academic engagement meets the natural beauty and hospitality of Eastern Washington.

There will be short courses, a plenary lecture, invited and contributed sessions, young investigator events, and a Student Paper Award with oral sessions. Email programchair@wnar.org or wnar@wnar.org with questions.

Registration information and other details about the meeting will be available on the WNAR web page.

2026 WNAR Expanding Opportunities Workshop

The WNAR Expanding Opportunities Workshop is a satellite workshop held in conjunction with WNAR for underrepresented students, and it emphasizes the importance of mentorship and belonging in the health and science fields. In 2026, the workshop will be opened to high school students from the region's Native American tribal communities. It is organized by the WNAR Justice, Equity, Diversity, and Inclusion (JEDI) Committee and the WNAR Leadership Committee. Please consider donating to support this cause.

WNAR Indigenous Student Travel Award

WNAR offers a travel supplement for an Indigenous student from within the WNAR region attend our annual conference. Eligible students include Indigenous peoples of North America and the Pacific Islands. To apply, please send a letter outlining your connection to Indigenous peoples and why you are looking forward to attending the WNAR annual conference, to: wnar@wnar.org. Please encourage your students to apply. Deadline for applications is 1 May 2026.

IBS/WNAR Outstanding Impact Award and Lectureship

Nominations for the annual IBS/WNAR Outstanding Impact Award and Lectureship will be due in fall of 2026, so please start thinking about nominating for the 2027 award submission. The awardee of the 2026 Outstanding Impact Award will be announced at the WNAR meeting in June.

The WNAR of IBS Outstanding Impact Award and Lectureship was established in 2021 to recognize an outstanding individual or team, regardless of race, gender, sexual orientation, nationality or citizenship, who has made a significant impact on our society through service and/or research in the development and application of statistical, mathematical, and data science theory and methods in the biomedical or environmental sciences. A significant impact can comprise either a single contribution of extraordinary merit or an outstanding aggregate of contributions that significantly impacts biosciences and environmental sciences. More information about the award process can be found on the WNAR award website.

Jessica Minnier
WNAR Secretary

Announcements
& UPCOMING EVENTS

IBS, IBS Regional and Non-IBS Events and Meetings

6th Conference of the Central European Network (CEN)
IBS Region Event
"Power of Data – Shaping the Future of Life Sciences"
18-21 May 2026
This joint conference of the Austro-Swiss Region (ROeS), the German Region (DR), and the Polish Region of the International Biometric Society (IBS)
Warszawa, Poland

8th International Conference on Advanced Research Methods and Analytics
"AI, Internet Data and Computational Methods in Social Sciences"
Valencia, Spain
1 - 3 July 2026
https://carmaconf.org

IBC2026
12-16 July 2026
COEX Magok
143 Magokjungang-ro, Gangseo-gu
Seoul, South Korea
www.ibc2026.org

The 8th Pacific Causal Inference Conference (PCIC 2026)
18-19 July 2026
XXXIV International
Tianjin, China

74th Biometric Colloquium in Conjunction as part of the DAGStat Conference
IBS Region Event
20-24 March 2028
74th Biometric Colloquium as part of the DAGStat Conference
Bremen, Germany

View the full meetings calendar here!
IBS, IBS Regional and Non-IBS Events and Meetings

Is something missing? Would you like to add your meeting or event to our calendar? If so, please send an email to IBS@biometricsociety.org with the following information:

- Event Title
- Event Description & Location
- Event Category (IBS Regional Event, IBS Event, Non-IBS Event)
- Event Link
- Start/End Date

Follow IBS **ON SOCIAL MEDIA!**