

stents, the new generation of which has been associated with improved survival,⁴ were only used in 2.7% of patients in the PCI group because they were approved in the last 6 months of the trial.

In current times, most coronary interventional cardiologists treat intermediate coronary lesions in stable angina patients only if they can prove that they are hemodynamically significant, either with an invasive (pressure wire) or a noninvasive functional test. This practice partially stems from the results of the FAME II trial,⁵ which revealed a significant reduction in urgent revascularization in the PCI (4%) vs the OMT group (16.3%) even though the investigators found no significant differences in all-cause mortality (PCI vs OMT: 1.3% vs 1.8%, 0.58) or myocardial infarction (5.8% vs 6.8%, $P < .56$). Furthermore, most centers use contemporary new generation drug-eluting stents; in a network meta-analysis of 93 553 patients in 100 randomized controlled trials,⁴ these stents were associated with reduced mortality (everolimus: 0.75, 0.59 to 0.96; zotarolimus [Resolute]: 0.65, 0.42–1.00) compared with medical therapy alone. Of note, this mortality benefit was not seen in patients treated with plain balloon angioplasty (0.85, 0.68–1.04), bare metal stents (0.92, 0.79–1.05), mainly used in COURAGE, or early generation drug-eluting stents (paclitaxel: 0.92, 0.75–1.12; sirolimus: 0.91, 0.75–1.10; zotarolimus [Endeavor]: 0.88, 0.69–1.10).

In summary, we agree that in stable angina patients the verdict is still out as to whether PCI adds a mortality benefit over and above OMT; however, there seem to be some signs that this may be the case with newer stent platforms. Our study suggests that patients on OMT treated with overlapping first generation bioresorbable scaffolds have similar 1-year outcomes to those treated with overlapping new generation everolimus-eluting stents, despite the latter being the leading force in coronary intervention.

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REFERENCES

1. Panoulas VF, Kawamoto H, Sato K, Miyazaki T, Naganuma T, Sticchi A, et al. Clinical Outcomes After Implantation of Overlapping Bioresorbable Scaffolds vs New Generation Everolimus Eluting Stents. *Rev Esp Cardiol*. 2016. <http://dx.doi.org/10.1016/j.recesp.2016.02.029>.
2. Boden WE, O'Rourke RA, Teo KK, Hartigan PM, Maron DJ, Kostuk WJ, et al. Optimal medical therapy with or without PCI for stable coronary disease. *N Engl J Med*. 2007;356:1503–16.
3. Tonino PA, De Bruyne B, Pijls NH, Siebert U, Ikeno F, van't Veer M, et al. Fractional flow reserve versus angiography for guiding percutaneous coronary intervention. *N Engl J Med*. 2009;360:213–24.
4. Windecker S, Stortecky S, Stefanini GG, da Costa BR, Rutjes AW, Di Nisio M, et al. Revascularisation versus medical treatment in patients with stable coronary artery disease: network meta-analysis. *BMJ*. 2014;348:g3859.
5. De Bruyne B, Fearon WF, Pijls NH, Barbato E, Tonino P, Piroth Z, et al. Fractional flow reserve-guided PCI for stable coronary artery disease. *N Engl J Med*. 2014;371:1208–17.

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Why Not Use Existing Knowledge: Bayesian Statistics



Por qué no utilizar el conocimiento previo: la estadística bayesiana

To the Editor,

We read with interest the article by Aranceta-Bartrina et al.,¹ whose objective was “to describe the prevalences of overall obesity and abdominal obesity in a representative sample of the Spanish population”.

We presume that the authors' true objective was to describe not the prevalence of obesity in the sample, but rather the true prevalence of obesity in the Spanish population. To do so, they selected a sample of 3966 individuals, ensuring it was representative, and then used it to calculate the percentage of individuals with obesity. To extrapolate these results to the Spanish population, they calculated 95% confidence intervals.

Frequentist statistics based on significance tests, confidence intervals, and hypothesis testing are widely used nowadays. The main advantages of this approach are its simplicity and easy reproducibility, as many of the calculations can be done manually. The main disadvantage is that it does not provide a rational answer to clinical questions. The original question, “What is the true prevalence of obesity in the Spanish population?” cannot be answered intelligibly using this type of statistics.

The authors¹ state that the rate of obesity was 21.6% (95% confidence interval, 19.0%–24.2%). To understand this interval, one must imagine taking repeated samples using the same model, such that in 95% of those samples, the intervals include the true population value.² Although difficult to understand, this does not mean that there is a 95% probability that the prevalence of obesity in the Spanish population is between 19% and 24.2%; therefore, it does not address the original question.

Bayesian statistics are an alternative to frequentist statistics. The Bayesian approach is more complex and may require Markov chain Monte Carlo simulations,^{2,3} but it has the advantage of intuitively answering questions such as this one and it takes existing knowledge into account. Instead of “confidence intervals”, it uses “credible intervals”. The credible interval is the range in which there is a 95% probability of finding, for example, the true population value.

This type of statistics is based on Bayes theorem. It uses prior probability, along with experience or observation, to calculate the *a posteriori* probability. This means that each new study is seen not as separate or independent from existing knowledge, but as adding new information and contributing to the creation of new knowledge; this then serves as a starting point for subsequent studies.²

Reading this article, one is reminded of the 2012 publication by Gutiérrez-Fisac et al.,⁴ whose objective was also to describe the prevalence of obesity in Spain by studying 12 883 individuals. According to the data provided, the prevalence of obesity in

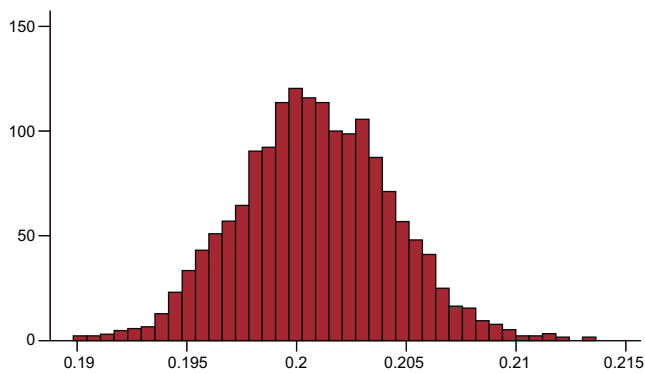


Figure. Histogram representing the obesity variable after 12 500 Markov chain Monte Carlo iterations using the Metropolis-Hasting algorithm.

persons aged between 18 and 64 years in their sample was 19.78%. If Bayesian statistics were used, it would then take these data as existing information to subsequently obtain deeper knowledge by calculating the credible interval.

In this approach, for example, if one takes a beta distribution as the *a priori* probability of obesity (1 898.7700),⁴ with the variable obesity and a Bernoulli distribution, and if one then adds the data obtained by Aranceta-Bartrina et al.,¹ after 12 500 iterations and a burn-in period of 2500, one would obtain an *a posteriori* obesity prevalence of 20.1% with a 95% credible interval of 19.4% to 20.8%. That is, this time there would indeed be a 95% probability that the overall prevalence of obesity in Spain is between 19.4% and 20.8%. The **Figure** shows a histogram representing the distribution of obesity according to Markov chain Monte Carlo simulations.

This coincides almost exactly with the confidence interval provided by Aranceta-Bartrina et al.¹ (19%-24.2%), because when studies are similar in design, the confidence interval and the credible interval tend to be similar,² although this is not necessarily the case. If Bayesian statistics are not used, there are 2 options: pay attention to only 1 of the studies and ignore the

other (even if the methodology of both is appropriate) or conduct a third study that generates more evidence and acts as a “tie breaker”, even in the knowledge that it will not answer the original question.

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REFERENCES

1. Aranceta-Bartrina J, Pérez-Rodrigo C, Alberdi-Aresti G, Ramos-Carrera N, Lázaro-Masedo S. Prevalence of general obesity and abdominal obesity in the Spanish adult population (aged 25–64 years) 2014–2015: The ENPE study. *Rev Esp Cardiol.* 2016;69:579–87.
2. Thompson J. The problem of priors. In: Thompson J, editor. *Bayesian analysis with STATA*. Texas: Stata Press; 2014. p. 1–8.
3. Gandhi M, Mukherjee B, Biswas D. A Bayesian approach for inference from a bridging study with binary outcomes. *J Biopharm Stat.* 2012;22:935–51.
4. Gutiérrez-Fisac JL, Guallar-Castillón P, León-Muñoz LM, Graciani A, Banegas JR, Rodríguez-Artalejo F. Prevalence of general and abdominal obesity in the adult population of Spain, 2008–2010: the ENRICA study. *Obes Rev.* 2012;13:388–92.

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Why Not Use Existing Knowledge: Bayesian Statistics. Response



Por qué no utilizar el conocimiento previo: la estadística bayesiana. Respuesta

To the Editor,

We would like to thank Hernández-Vaquero et al. for their interest and comments on our study.¹ We agree that a Bayesian approach could enhance the analysis of data from the ENPE study (Spanish acronym for the Nutritional Study of the Spanish Population), and we will consider this for future publications. The debate on Bayesian vs frequentist methods has been open for some time.^{2,3}

We used frequentist inference to analyze data collected from a random probability sample ($n = 3966$), with a careful methodological protocol and quality controls. All the studies we used as reference and context, conducted in Spain and other countries,

used this approach. Hernández-Vaquero et al. state that their Bayesian estimate coincides almost exactly with our frequentist estimate, which often happens when the studies are of similar design and the sample size is large.

We share the view of many other authors, that neither approach is superior: each has its advantages and limitations. It is true that interest in Bayesian methods is increasing, as reflected in the changes in the number of publications retrieved when searching the term “Bayesian” in PubMed.⁴ In studies from the last 6 years (2010–2015), 16 665 publications include “Bayesian” in the title or abstract, and 81 321 include “obesity”, but only 71 records contain both “Bayesian” and “obesity”. Most epidemiological research has been done (and continues to be done) using a frequentist approach, without jeopardizing the knowledge acquired. Many authors use both approaches, depending on the research question, the study design, the size and design of the sample, the type of data, etc.⁵ We advocate a pragmatic approach, based on reasoning, reflection, and contextualization of the data.