We Get Letters

We Are Accused of Over-cheerfulness

Letters to the editor: OK, bucko, step outside and say we're afraid of population growth. Go ahead. See what happens.

By: Miller-McCune Staff | April 24, 2009 | 04:15 PM (PDT) | 15 Comments

Colleen Shaddox

Whoever told you to mail me a free copy of *Miller-McCune* certainly had their insider information right. I've spent most of the day reading almost all the great articles. I love your compassion, optimism, realism, worldwide perspective and data-based and solution-based approach. I intend to subscribe tomorrow.

I do have a disappointment, however, and I think I understand your reasoning. You do not wish to emphasize the dangers of population growth because it does not lead to any cheerful solutions.

Colleen Shaddox points out ("Simply Rwandan," March-April) that Rwanda, the size of Vermont, has a "rapidly growing population of 10 million," and also that "Rwanda has always been a country of large families." Almost certainly the population will exceed 20 million before many decades, right? It is not at all realistic to assume that most of the additional 10 million will be bankers, tourist guides, software programmers and high-tech technicians. We can assume that there will therefore be intense pressures for land — for cows and farming. Yes, I appreciate that all the articles end up on an upbeat note. But wouldn't effective steps toward family planning make Rwanda's future much brighter?

I live in Guatemala, Central America, and the resistance to family planning is very similar. In my lifetime, the population has doubled twice and will likely double again to about 25 million in the next 30 years. Probably not coincidentally, we have had a long, bloody, evil and horrible civil war. We are now beset by drug running, organized crime, family violence and violence against women, environmental degradation and massive under-employment. Would family planning have completely prevented the suffering? Of course not. But population growth will eventually have to end. Humans can make the choices — or let tragedy make the choices for us.

Paul E. Munsell, Ph.D.
Guatemala City, Guatemala

For Those of You Who Paid Attention in Statistics Class...
Can we ever prevent the imprisonment of innocent people?

Following up on Steve Weinberg's article ("Innocent Until Reported Guilty," October 2008) and the subsequent commentary, let me offer a sad but sober dose of mathematical reality. The conclusion is that so long as only a very small minority of people commit crimes and the criminal justice system is fair ("fair" meaning that all people are equally subject to investigation) there will always be a very large proportion of innocent people convicted.

Now the supporting argument, made by way of an example:

Suppose there are 10,000 true criminals in the United States annually. I don't know how many there really are, but let's assume 10,000 for the example.

Second, let's assume that the criminal justice system is 99.9 percent accurate. By "system" I mean the entire system, starting with investigation and prosecution and ending with punishment. I know that 99.9 percent may be Pollyannaish, but, again, let's accept it for the example. This means that the probability of a guilty person being caught and successfully tried, convicted and punished is 99.9 percent and the probability of an innocent person being convicted is but 0.1 percent.

Now let us ask and answer the key question: If a person is found guilty of a crime, what is the probability that s/he is guilty?

This probability is a ratio that has, in its numerator the number of guilty people successfully punished = .999 x 10,000 = 9,990. In the denominator is the number of guilty people being punished plus the number of innocent ones being punished. We already have the guilty part of this (9,990). The innocent part is .001 times the number of innocent people in the U.S., or .001 x 300,000,000 = 300,000.

So the answer to the question is:

9,990/(9,990+300,000) = 9,990/309,990 = 3%

Or, expressed another way, 97 percent of those in prison, under the circumstances of this example, would be innocent. Of course if the true number of criminals is 100,000, then the proportion of innocents is "only" 70 percent. It is amazing that so few horror stories are being told.

Howard Wainer
Professor of Statistics
The Wharton School
of the University of Pennsylvania

A question from the editor: We'd like to double-check some of your reasoning with you. You create a fraction with the number of people successfully punished in your example in the numerator (in this case, 9,990) and in the denominator, you use 300,000,000 as the number of innocent people in the U.S.

We were wondering, for your example to be valid, wouldn't you have to place a number of "charged" innocent people in the denominator, and not the entire U.S. population?

A response from Wainer: Thank you for taking the time to read and think about my example. No, the denominator is as I have specified it. The figure 99.9 percent represents the probability of getting it right of the whole process — this means initial investigation, charging, prosecuting, convicting and imprisoning.

So it assumes that at the beginning of any investigation, everyone is under consideration (although a large proportion may be eliminated quickly). This assumption may not be true — it may be that some groups of people (the usual suspects) are always considered, and some never are. I was proceeding under the democratic assumption that initially at least we are all equal under the law.

Note, by the way, that the same arithmetic is informative in evaluating medical testing. Each year in the U.S., 186,000 women are diagnosed, correctly, with breast cancer. Mammograms identify breast cancers correctly 85 percent of the time. But 33.5 million women each year have a mammogram and when there is no cancer it only identifies such with 90 percent accuracy. Thus if you have a mammogram and it results in a positive (you have cancer) result, the probability that you have cancer is:

186,000/(186,000+3.35 million) = 4%

So if you have a mammogram and it says you are cancer free, believe it. If it says you have cancer, don't believe it.

The only way to fix this matches your question — reduce the denominator. Women less than 50 (probably less than 60) without family history of cancer should not have mammograms.

An editor's challenge: We still suspect that professor Wainer knows his statistics cold but scored less well in Assumption Making 101. If you know we're right or wrong, go online at Miller-McCune.com and tell us why. Our comments section awaits your brilliance.

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Comments

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POSTED BY: elizabeth brown, May 16, 2009, 04:29 PM re: wainer's statistics. the error here is easy to spot- the .1% who are innocent is .1% of the total number of people convicted of crimes, not .1% of the total population. if .1% of the total population was convicted of crimes that they did not commit, that would bear no relation to the data given in the beginning of the problem: wainer stated that the number of criminals (or let's say crimes, for simplicity) is 10,000 per year. if the justice system punishes the right person for the crime 99.9% of the time, that leaves the other .1% when an innocent person is blamed. the population of the country is totally irrelevant in this problem; what we want to know is the proportion of convictions that are innocent. you can only conflate the two statistics if there are the same number of crimes investigated and charged each year as there are residents in the US, which is obviously not the case. To put it another way, saying that .1% of convicts are innocent is not the same as saying that there is a .1% chance of being wrongly convicted. why? because his jump from statistics on those convicted to statistics on the general population leave out the largest group of people- those who have neither committed a crime NOR been convicted. For everyone who has been convicted, innocent or guilty, there was first a crime commited that was then investigated and charged. There is a crime for every convict, even if they are not correctly matched. there is not a crime for every US resident.

POSTED BY: Margaret Cibes, April 29, 2009, 07:51 AM

I'm not qualified to critique the assumptions behind the math, which are in most cases appropriate, but I suggest that there's a typo in the line containing "186,000 / (186,000 + 3.35 million)." As someone pointed out here earlier, the 4% is slightly low. The denominator should represent the sum of correct (186,000) and incorrect (?) cancer diagnoses. As it stands, the 3.35m figure represents 10% of all 33.5m mammograms; however, it should be "slightly" smaller because it should represent 10% of mammograms for only people who do not actually have cancer (approx. 33.3m = 33.5m - 0.22m = 33.5m - 186,000/0.85). This doesn't change the final probability (4%) enough to matter much. In any case, I applaud Wainer's spotlight on Bayes theorem!

POSTED BY: Al Warner, April 28, 2009, 10:11 AM

Loathe as I am to take on any professor on home turf, I do think there is something awry with this analysis and it has to do with how the argument subtly shifts from investigating a crime to assessing a population. Prof. Weiner stipulates a justice system that is 99.9% accurate – but applied to what? That is, he applies the math to an entire population (as in the government seeking out and sequestering criminals) versus the application to specific cases (as in the government responding to a specific crime and seeking the single person responsible). The question is not how many people are there in the US – but how many crimes are committed? If we assume that the 10,000 criminals commit 10,000 crimes (not the 309.990 implied in the letter) and it is these events that are investigated with 99.9% efficiency, we should get a rather different result. We'd still have imprisoned the 9,990 true bad guys – but only 10 innocents. (Well, "only" in the sense that 10 is not as bad as 300,000).

POSTED BY: Anonymous User, April 28, 2009, 07:12 AM

The problem with Professor Wainer's example is, as stated, the assumptions- not the assumption that everyone is equal under the law (and should therefore be considered in the denominator) but the assumption that there are only 10K true criminals. According to recent statistics, there are 1.6million prisoners under state or federal authority and the US adult (18+) population is 217.8million. Assuming that the number of prisoners under supervision represents the number of crimes for which someone is responsible (not necessarily guilty), then the accuracy rate is over 88% and the innocents are less than 12%. The mathematical reality is that this represents almost 200k real people. I am more disturbed by the assumption Professor Wainer makes based on the medical example: "Women less than 50...should not have mammograms". Decreasing the denominator in this example increases the accuracy of the mammograms, but does not help the women whose cancer then goes undetected. The important thing to remember in using statistics is the impact of the results- in this case, it is far better for an individual to get the test and have it be a false positive (96% of the time), than to not be tested and find the disease too late for it to be treated.

POSTED BY: Anonymous User, April 27, 2009, 04:21 PM

Editor, Professor Wainer is entitled to hypothesize an 'accuracy rate' of 99.9% for criminal justice. He is also allowed to hypothesize a group of 10,000 structured in a most unusual way. If he defines accuracy rate as the percent of convicted who are truly guilty, he can then determine the number of correct and incorrect convictions among his 10,000 under his scenario. What he is not entititled to do is apply his hypothetical error rate of .001 to his 'innocent' population of 300 million. The reasons are complex but we can use an example - as does Wainer. Hypothesize an accuracy rate of 100%,- surely a trivial difference from 99.9%.Now his ratio becomes 10,000/ 10,000 + .00 (300 million) which = 1.00 and the probability of an innocent having being convicted is zero, not his 97%. This is so regardless of the number of true criminals. It is also as legitimate a conclusion as Wainer's and illustrates the dangers of such statistical speculation.

POSTED BY: Anonymous User, April 26, 2009, 01:58 PM

"I see this comment posed twice now: "Two sentences from the same paragraph... Huh?" This is not a discrepancy. One is the probability that the test is positive, given that you have cancer. The other is the probability that you have cancer, given that the test is positive." That is crystal clear. Thank you for the clarification. (Your example just made it more confusing.) Perhaps this is the reason the article in question is under so much scrutiny: the english is sloppy and ambiguous.

POSTED BY: Tamas Oravecz, April 26, 2009, 01:10 PM

I agree with those pointing out that the denominator should be 10,000 or less. Prof Wainer's assumption is that the justice system is working like a quaranteen, lumping up people when an infection detected. Knowing the efficiency of the justice system to solve crimes makes it unlikely that more people are put on trial than the number of actual criminals, even if each comits multiple crimes. If 10,000 is used as the denominator (and leaving the other assumptions correct), then the probability of an innocent person being convicted is closer to 0.0001%. The numbers in the equotion of the breast cancer example are correct, except the solution: the result is actually 5.3% rather than 4%. Another way to look at the usefulness of mammograms is the following (after some additional calculation): If the mammogram is positive, the individual's risk for having breast cancer increased ~ 8-fold compared to the general population who are taking mammogram (from 0.65% to 5.3%); if it's negative, then the risk decreased ~ 7-fold (to 0.099%).

POSTED BY: Anonymous User, April 25, 2009, 11:08 AM

I see this comment posed twice now: "Two sentences from the same paragraph... Huh?" This is not a discrepancy. One is the probability that the test is positive, given that you have cancer. The other is the probability that you have cancer, given that the test is positive. Suppose for example that 101 people take the test -- 1 has cancer and the other 100 don't. And suppose that the test has a 100% chance of being positive if the patient has cancer, and a 10% chance of being positive if they don't. Then you can expect 11 people to test positive (1 cancer case and 10 non-cancer cases), so that the probability of having cancer, given that the test is positive, is 1/11, or about 9%.

POSTED BY: Anonymous User, April 24, 2009, 08:01 PM

Two sentences from the same paragraph: "Mammograms identify breast cancers correctly 85 percent of the time." and "Thus if you have a mammogram and it results in a positive (you have cancer) result, the probability that you have cancer is:...4%." Huh?

POSTED BY: Anonymous User, April 24, 2009, 04:23 PM

It seems like there are a number of ways to diagnose the problem; here is my understanding of it. Let's say that 10,000 "true" criminals means 10,000 crimes. AND, let's say that there are 10,000 arrests, trials, and convictions (assume that there are no mistrials and every crime is "solved" in the sense that someone is sent up for trial). If the system works properly 99.9% of the time, then 9,990 true criminals have been convicted and 10 innocent people have been convicted. In other words, the probability that you are guilty if you are convicted is 99.9%, which is what we should expect if the system works properly 99.9% of the time. On the assumption that someone is convicted for every crime, the percentage of prisoners who are innocent is 0.1%. Wainer's numbers would work if there were 10,000 real criminals, but they were all very busy, committing among them a total of 309,990 crimes--and if the police and courts arrested and convicted someone different for each crime, putting 300,000 innocent people in jail and catching 9,990 of the true criminals. But then it wouldn't be true at all that "the probability of an innocent person being convicted is but 0.1 percent," as Wainer specifies in his original letter.