



THE ART AND SCIENCE OF PROGNOSIS

by Daniel J. Bressler, MD, FACP

“DOC, WILL THIS affect my life expectancy?”

Asked of me by a 93-year-old retired rocket designer recently admitted with CHF exacerbation after reading the hospital booklet given to him about that diagnosis.

“Medicine is a science of uncertainty and an art of probability.” William Osler, MD

It's tough to make predictions, especially about the future. Yogi Berra.

Nicholas Christakis, MD, a professor of medicine and sociology at Yale, in his 1999 book, *Death Foretold: Prognosis and Prophecy in Medical Care*, proposes that medical

practice has three prongs: diagnosis, prognosis, and treatment. Of these, doctors do the worst (and put in the least amount of time and training) in prognosis. He outlines the reasons and includes among them a fear that a negative or poor prognosis will become a self-fulfilling prophecy, with the doctor's words acting like a curse and leading to an unnecessarily shortened life. As a consequence, doctors either avoid prognosis altogether or gloss over it with excessive optimism.

As an internist who graduated medical school in the '80s, I came of age with a few classic

Numbers

*You can count the numbers on your hands
Even right now, even while reading this
Each little sausage with a personality assigned so long ago
But not forgotten. We call them digits, numbers.*

*You can count the number of planets in our solar system
Color coded in a children's book on space
It's either eight or nine (depending on Pluto's status)
Almost the same as the number of fingers if you add the sun.*

*We can count, too, the days in a week
In a month and even in a year.
Turns out there's 365.2422 a number awkward enough to prove
(As if we need such proof this late in history)
That nature's perfection is not the same
As what humans imagine perfection to be.*

*And speaking now, just for a moment, about
Human imperfection, what about the number of our days?
I mean your days and my days.
For most of us, it is more than a handful of fingers or planets
But then again, not so many as the stars on a June night
But the number is something, some “X.”*

*“Solve for X,” said Mr. Arredondo in high school algebra
Solve for X, says the radiation oncologist and the cardiac surgeon
Solve for X, say the Four Horsemen on their cybernetic steeds.
It is a final exam, of sorts. It's one we all must take.
This, too, is a school and we all eventually graduate
Our final answers given, one way or another,
Walking off the stage down the steps into an unknown world.*

*So I count my fingers, add my toes
Multiply by the number of planets
And include, to a false precision of 4 decimal places
The solar year. That gives me a number, some number.*

*And then, for extra credit, I go to ask the Principal
If I might take a look in the back of the book
You know, the book of counting, of planets, of solar systems
And oncology and cardiology
Let me read ahead to find the number
To get the correction factor that makes it all add up.*

*And the Principal invites me to the front of the class.
On the desk is the book of life, the book of books
The entire history of the universe bursting from every page.
It's a living record that overflows up until the present moment;
After that, nothing but blank pages.
Ah, yes, the Principal smiles. You want the number.
But I don't have the number.
The book does not have the number.
Solve for X.*

predictive tools that used simple tally methods to determine likely outcomes. These included the CHAD score (its latest iteration is called the CHA₂DS₂-VASc) for the calculation of stroke risk in atrial fibrillation, the APACHE score (its latest update is APACHE IV) for risk of death in ICU patients, and the Pugh Child score (now called the Child-Turcotte-Pugh) for predictions about outcomes in cirrhosis of the liver. Since the publication of *Death Foretold*, there has been an explosion in the number of prognostic tools that use the best available data to predict various kinds of outcomes. There are now aggregators of those tools available online and in smartphone apps. Ones that I use in my practice include QXMD (qxmd.com) which

covers the waterfront, the Memorial Sloan Kettering (mskcc.org/nomograms) for cancers, and ePrognosis (eprognosis.ucsf.edu) for geriatrics. These sites and apps integrate the hundreds of various predictive tools from the full spectrum of medical specialties.

These tools can give practicing physicians some additional confidence in the statistics of their predictions but do not remove the onus their predictions have on influencing patients' quality of life and even lifespan. In this regard, context is everything. The first context is that of statistics themselves. They apply to groups but not individuals. Every normal distribution curve has tails with outliers. Of course there are tails on both sides. For every patient with glioblastoma multiforme who

lives five years, there is one who is dead in a month. The capacity to convey the upside and downside of statistical facts is a skill that a compassionate physician must master. There is also the concept of current lifestyle practices affecting outcomes. Someone with alcohol abuse disorder who stops drinking certainly has a better expected outcome than one who doesn't, regardless of the other factors on the nomogram. And finally, there is the issue of technologic innovation. Before Gleevec (imatinib), chronic myelogenous leukemia had a five-year mortality rate of 50%; it has now dropped to 5%. I sometimes tell my patients with an aggressive cancer that one of our goals is to keep you alive with the current technology so that you can live to benefit

from the better ones still in the pipeline.

As for that 93-year-old whose quote begins this essay? If I had looked him up 10 years ago, these tools would have predicted that he would be dead for five years by now. So much for our conversation last night about rocket engine design, carbon-dating the earth's crust, and World War II adventures. This poem, *Numbers*, is dedicated to him. **SDP**



Dr. Bressler, internist and SDCMS-CMA member since 1988, is chair of the Biomedical

Ethics Committee at Scripps Mercy Hospital and a longtime contributing writer to San Diego Physician.

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