A Clinician's Guide to Statistics and Epidemiology in Mental Health

A Clinician's Guide to Statistics and Epidemiology in Mental Health

Measuring Truth and Uncertainty

S. Nassir Ghaemi MD MPH

Professor of Psychiatry, Tufts University School of Medicine
Director, Mood Disorders Program, Tufts Medical Center
Boston, Massachusetts

CAMBRIDGE UNIVERSITY PRESS

CAMBRIDGE UNIVERSITY PRESS
Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore, São Paulo, Delhi

Cambridge University Press
The Edinburgh Building, Cambridge CB2 8RU, UK

Published in the United States of America
by Cambridge University Press, New York

www.cambridge.org
Information on this title:
www.cambridge.org/9780521709583

First published 2009

Printed in the United Kingdom at the University Press, Cambridge

A catalog record for this publication is available from the British Library

Library of Congress Cataloging in Publication data
Ghaemi, S. Nassir.
A clinician's guide to statistics and epidemiology in mental health : measuring truth and uncertainty / S. Nassir Ghaemi.
p. ; cm.
Includes bibliographical references and index.
ISBN 978-0-521-70958-3 (pbk.)
1. Psychiatry – Statistical methods. 2. Psychiatric epidemiology.
I. Title.
[DNLM: 1. Psychiatry – methods. 2. Statistics as Topic.
3. Mental Disorders – epidemiology. WM 30 G411c 2009]
RC467.8.G53 2009
362.2′0422 – dc22 2009019273

ISBN 978-0-521-70958-3 paperback

To my father, Kamal Ghaemi MD
and my mother, Guity Kamali Ghaemi

Errors in judgment must occur in the practice of an art which consists largely of balancing probabilities.

William Osler (Osler, 1932; p. 38)

The genius of statistics, as Laplace defined it, was that it did not ignore errors; it quantified them.

(Menand, 2001; p. 182)

Contents

Preface

Medicine without statistics is quackery; statistics without medicine is numerology. Perhaps this is the main reason why clinicians should care about statistics.

Statistics in medicine began in the early nineteenth century (it was called "the numerical method" then) and its debut involved disproving the most common and widely accepted medical treatment for millennia: bleeding. From ancient Rome until 1900, all physicians – from Galen to Avicenna to Benjamin Rush – strongly and clearly advocated bleeding as the treatment for most medical illnesses. This was based on a theory, most clearly defined by Galen: four humors in the body, if out of balance, led to disease; bleeding rebalanced the humors.

Of course this was all wrong. Even the dullest physician today would know better. How was it disproven?

Statistics.

Pierre Louis, the founder of the numerical method, counted 40 patients with pneumonia treated with bleeding and showed that the more they were treated, the sooner they died. Bleeding did not treat pneumonia, it worsened it (Louis, 1835).

Counting – that was the essence of the numerical method; and it remains the essence of statistics. If you can count, you can understand statistics. And if you can't (or won't) count, you should not treat patients.

Simply counting patients showed that the vaunted experience of the great medical geniuses of the past was all for nought. And if Galen and Avicenna could be mistaken, so can you.

The essence of the need for medical statistics is that you cannot count on your own experience, you cannot believe your eyes, you cannot simply practice medicine based on what you think you observe. If you do this, you are practicing pre-nineteenth century, prescientific, prestatistical medicine.

The bleeding of today, in other words, could well be the Prozac or the psychotherapy that so many of us mental health clinicians prescribe. We should not do things just because everyone else is doing it, or because our teachers told us so. In medicine, the life and death of our patients hang in the balance; we need better reasons for preserving life, or causing death, than simply opinion: we need facts, science . . . statistics.

Clinicians need statistics, then, to practice scientifically and ethically. The problem is that many, if not most, doctors and clinicians, though trained in biology and anatomy, fear numbers; mathematics is foreign to them, statistics alien.

There is no way around it though; without counting, medicine is not scientific. So how can we get around this fear and begin to teach statistics to clinicians?

I find that clinicians whom I meet in the course of lectures, primarily about psychopharmacology, crave this kind of framing of how to read and analyze research studies. Residents and students also are rarely and only minimally exposed to such ideas in training, and, in the course of journal club experiences, I find that they clearly benefit from a systematic exposition of how to assess evidence. Many of the confusing interpretations heard by clinicians are due to their own inability to critically read the literature. They are aware of this fact, but are unable to understand standard statistical texts. They need a book that simply describes what

they need to know and is directly relevant to their clinical interests. I have not found such a book that I could recommend to them.

So I decided to write it.

A final preliminary comment, aimed more at statisticians than clinicians. This book does not seek to teach you how to *do* statistics (though the Appendix provides some instruction on conducting regression analysis); it seeks to teach you how to *understand* statistics. It is for the clinician or researcher who wants to understand what he or she is doing or seeing; not for a statistician who wants to run a specific test. There are no discussions of parametric versus non-parametric tests here; plenty of textbooks written by statisticians exist for that purpose. This is a book *by* a clinical researcher in psychiatry *for* clinicians and researchers in the mental health professions. It is not written for statisticians, many of whom will, I expect, find it unsatisfying. Matters of professional territoriality are hard to avoid. I suppose I might feel the same if a statistician tried to write a book about bipolar disorder. I am sure I have certain facts wrong, and that some misinterpretations of detail exist. But it cannot be helped, when one deals with matters that are interdisciplinary; some discipline or another will feel out of sorts. I believe, however, that the large conceptual structure of the book is sound, and that most of its ideas are reasonably defensible. So, I hope statisticians do not look at this book, see it as superficial or incomplete, and then simply dismiss it. They are not the ones who need to read it. And I hope that clinicians will take a look, despite their aversion to statistics, and realize that this was written for them.

Acknowledgements

This book reflects how I have integrated what I learned in the course of Master of Public Health (MPH) coursework in the Clinical Effectiveness Program at the Harvard School of Public Health. Before I entered that program in 2002, I had been a psychiatric researcher for almost a decade. When I left that program in 2004, I was completely changed. I had gone into the program thinking I would gain technical knowledge that would help me manipulate numbers; and I did. But more importantly, I learned how to understand, conceptually, what the numbers meant. I became a much better researcher, and a better teacher, and a better peer reviewer, I think. I look back on my pre-MPH days as an era of amateur research almost. My two main teachers in the Clinical Effectiveness Program, guides for hundreds of researchers that have gone through their doors for decades, were the epidemiologist Francis Cook and the statistician John Orav. Of course they cannot be held responsible for any specific content in this book, which reflects my own, sometimes contrarian, and certainly at times mistaken, views. Where I am wrong, I take full responsibility; where correct, they deserve the credit for putting me on a new and previously unknown path. Of them Emerson's words hold true: a teacher never knows where his influence ends; it can stretch on to eternity.

I would not have been able to take that MPH course of study without the support of a Research Career Development Award (K-23 grant: MH-64189) from the National Institute of Mental Health. Those awards are designed for young researchers, and include a teaching component which is meant to advance the formal research skills of the recipient. This concept certainly applied well to me, and I hope that this book can be seen in part as the product of taxpayer funds well spent.

Through many lectures, I expressed my enthusiasm to share my new insights about research and statistics, a process of give and take with experienced and intelligent clinicians which led to this book. My friend Jacob Katzow, perhaps the longest continual psychopharmacologist in clinical practice in Washington DC, consistently encouraged me to seek to bridge this clinician/researcher divide and helped me to keep talking the language of clinicians, even when describing the concepts of statisticians. Federico Soldani, who worked with me as a research fellow before pursuing a PhD in public health at Harvard, helped me greatly in our constant discussion and study of research methodologies in psychiatry. Frederick K. Goodwin, always a mentor to me, also has continually encouraged this part of my academic work, as has Ross Baldessarini. With a secondary appointment on the faculty of the Emory School of Public Health in recent years, I made the friendship of Howard Kushner, who also helped mature some of my epidemiological and public health-oriented thinking. Among psychiatric colleagues who share my passion on this topic, Franco Benazzi read an early draft, and Eric Smith provided important comments that I incorporated in Chapters 4–6. Richard Marley at Cambridge University Press first suggested this project to me, persisted in his request even after I expressed reservations, tolerated my passive-aggressive tardiness in the face of a daunting task, and, in the end, accepted the only end result I could produce, not a straightforward text, but a critique. Not all editors and publishers would be so patient and flexible.

My family continues to tolerate the unique gift, and danger, of the life of the academic: even when at home, ideas still roam around in one's mind, and there is no end to the potential effort of reading and writing. They set the limits, and provide the rewards, that I need.