

**Insight & Invention
KHC HC 302
Spring 2013**

Course Overview:

How do different disciplines approach understanding the world? This course – a continuation of the fall course – explores how three additional fields – engineering, public health, and music – approach the research process. This exploration provides a basis for confronting the general questions: What do we know? How do we know it? What does knowledge mean? -- thereby deepening our understanding of different forms of inquiry.

We will devote roughly one-third of the course to each of the three disciplines under consideration. There will be two lectures per week (Monday and Wednesday) followed by a group discussion meeting (Friday).

Your assessment will be based on your performance on problems sets, labs, readings, papers, and other activities during the semester. The course will sharpen the writing and quantitative skills developed during your freshman year.

Grading Scheme

Each of the three units will account for 30% of the final grade, while the remaining 10% will turn on the faculty's assessment of your contributions across the three units and your performance on any culminating exercises at the end of the course. You must complete all assignments. Failure to complete assignments may result in failure of the course.

Each unit's grades will be calculated as follows:

1. Music: (three 3-page papers, 20% each); one 5-page, end-of-unit paper, 30%; 10% for discussion and related digest in the form of an ejournal.
2. Engineering: 2 papers (50% of the grade); homework assignments and labs (30%); and final assignment (20%)
3. Public Health: Engagement in class (20% of the grade); Critical Book Review (30%); Final Paper (50%)

Code of Conduct

Students are expected to abide by both KHC and BU's Undergraduate Academic Code of Conduct. Both can be found at <http://www.bu.edu/uhc/current-students/policies/>

Lecture Times & Location

When: Monday and Wednesday, 9:30-11:00
Where: CAS 226

Discussion Times & Locations

B1: Friday, 9:30-11:00 am	PHO 202	(w/ TBD as a break out room)
B2: Friday, 2:30-4:00 pm	SMG 220	(w/TBD as a break out room)

Lab Day/Times and locations

Please refer to unit 2 (Biomedical Engineering) for more information regarding the labs

Course website: blackboard.bu.edu

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Faculty

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Office hours:	M 12:00-1:00 pm W 12:00-1:00 pm	M 8:30-9:30am W 11am-12pm	Weeks 1-10: by appointment or after class Weeks 11-15: W 11am – 12pm and Fridays by appointment

Teaching Assistants/Discussion Leaders

	Nate Meneer nmeneer@bu.edu	Azatuhi "Az" Ayrikyan az.ayrikyan@gmail.com 617-353-5882	Nancy Scott nscott@bu.edu 617-414-1278
Office:	808 Comm. Ave Rm 272A	36 Cummington St Rm 311	Crosstown Center, 362
Office hours:	Jan. 23 – Feb. 20 W 11:15 -12:15 T 4-5pm <i>and by appointment</i>	<i>and by appointment</i>	F 11am-12pm or after class <i>and by appointment</i>
	After Feb. 20 <i>By appointment</i>		

Unit 1 – Prof. Victor Coelho: “The Riffings and Writings of Music History”

The history of music, like the history of any field, is the result of how scholars “assemble” events of the past. Historians make choices to include some events while excluding others; they provide “weight” to one event over others, resulting in the exclusion of many events and participants in history. History (or, more precisely, *historiography*) tells us how historians interpret the evidence they have collected (which can range from scant to copious), how they gather and examine their materials, what analytical and comparative tools they use, why they place primacy on certain traditions and ignore others, how their histories are altered (or not) with the discovery of new evidence, and how their personal ideologies play into the histories they write.

Similar to the fields of Public Health and Engineering, two fields that we will consider in this class, a tension exists in the field of Music History between theoretical and applied approaches, between the resistance and acceptance of new information, and between convention and innovation. In short, our histories have been managed by ideology and thought, not really by the persuasion or ambiguity of the evidence. Consider the famous example of eyeglasses. We know that people wore them to correct their vision already by 1300—there are many examples in Medieval art of scribes and monks wearing glasses. So, what took another 300 years to consider grinding the glass a little thinner and increasing its curvature to make a telescope, enabling them to see things in the distance, or ponder the sky? The technology and device to make things larger existed right in front of their eyes, but their capacity for thinking in this manner was in the back of their head (or even elsewhere).

Accordingly, in this unit we will look at music history as the product of how musicologists and ethnomusicologists gather, analyze, and choose (at our peril) our materials; how we decide on stylistic and period demarcations; why we place primacy on some music over others, and how we judge some music to be classified as “masterworks” and not others. Our coverage will try and understand the disputes between cultural and aesthetic priorities, between quantitative and qualitative judgments about music, between the “value” of certain styles, and the various methods, from traditional to new, for studying music history.

Grading:

Three 3-page papers (20% each); one 5-page end-of-unit paper, 30%; 10% for discussion and related digest in the form of an ejournal.

Texts:

(Course text available for download):

<http://www.fileden.com/files/2009/6/22/2485348/Music%20-%20A%20Very%20Short%20Introduction.pdf>

Weekly readings as listed are available on the Blackboard site or through JSTOR.

Lecture Schedule

1. Wed, Jan 16: Knowledge and Evidence in Studying Music

Reading:

- Cook, 1-18;
- Blair Sullivan, "Musicology: Principal Methodologies for Musicological Research," available online at <http://science.irank.org/pages/10338/Musicology-Principal-Methodologies-Musicological-Research.html>

2. Wed, Jan 23: Constructing (and De-constructing) Historical Periods: The Problem of Biography

Reading:

- Cook, 19-38
- Lewis Lockwood, *The Music and Life of Beethoven* (New York: Norton, 2003), 181-201.
- Maynard Solomon, "The Dreams of Beethoven," *Beethoven Essays* (Cambridge, MA., Harvard University Press), 56-76.

3. Mon, Jan 28: Conventional Medicine: The Canon and the "Masterwork"

Reading:

- Cook, 39-50; 74-84.
- Anne Schreffler, "Musical Canonization and Decanonization in the Twentieth Century" http://www.academia.edu/241625/Musical_Canonization_and_Decanonization_in_the_Twentieth_Century

4. Wed, Jan 30: Studying a Masterwork: Form and Analysis in Beethoven's "Eroica" Symphony

Reading:

- Cook: 51-73
- Lewis Lockwood, *Beethoven*, 202-13.

5. Mon, Feb 4: Galileo, Monteverdi, and the Conflict of Theory and Practice

Reading:

- Alexander Silbiger, "Music and the Crisis of Seventeenth-Century Europe," in *Music and Science in the Age of Galileo*, ed. Victor Coelho (Dordrecht: Kluwer, 1992), 35-44.
- Penelope Gouk, "Music and the Sciences," in *The Cambridge History of Seventeenth-Century Music*, ed. T. Carter & J. Butt (Cambridge: Cambridge University Press, 2005), 132-57.

6. Wed, Feb 6: **Alternative Performance: The Early Music Movement and its Challenge to Convention**
Reading:
- Cook, 85-101
 - Richard Taruskin, "'Alte Musik' or Early Music? *Twentieth-Century Music* 8 (2012), 3-28.
 - Taruskin, "The Spin Doctors of Early Music," *The New York Times*, July 29, 1990.
7. Mon, Feb 11: **"New" Musicology: Gender, Colonialism, and Eco-Musicology**
Reading:
- Cook, 102-124
 - Victor Coelho, "Music in New Worlds," in *The Cambridge History of Seventeenth-Century Music*, 88-110.
 - "Ecomusicology" [A Colloquy]: in *Journal of the American Musicological Society* 67 (2011), 391-419
8. Wed, Feb. 13: **Globalizing Music History: World Music, Jazz, and Rock**
Reading:
- Susan McClary and Robert Walser, "Start Making Sense: Musicology Wrestles with Rock," in *On Record*, ed. Simon Frith & Andrew Goodwin (London: Routledge, 1990), 237-49.
 - Lewis Porter, "Guidelines for Jazz Research," *Bulletin of the Council for Research in Music Education* 95 (1987/88), 3-12.
 - Bruno Nettl, "'The Seminal Eighties: Historical Musicology and Ethnomusicology,'" in *Nettl's Elephant: On the History of Ethnomusicology* (Urbana, 2010), 3-21.
9. Mon, Feb 20: **Writing Music History in the 21st Century**
Reading,
- Joseph Auner, "'Sing It for Me': Posthuman Ventriloquism in Recent Popular Music," *Journal of the Royal Musical Association* 128 (2003) 90-122.
 - "Studying U.S. Music in the Twenty-First Century" [A Colloquy]: in *Journal of the American Musicological Society* 64 (2011), 689-714.

Unit 2 - Prof. Muhammad Zaman - Biomedical Engineering: "Engineering Health"

Engineers like to build things, big and small, and use them to solve problems. From hanging bridges to nanotechnology, engineers through their tools continue to shape and transform our daily life. But can they use some of the same principles to build tools to solve some of the most pressing problems in modern medicine?

This unit will explore the fundamentals, quantitative and qualitative approaches, opportunities and challenges in applying engineering principles to improve human health and combat disease. We will focus on why should we develop quantitative approaches, and why are they better than qualitative tools? We will start by looking at a broad spectrum of research approaches, ranging from genetic

circuits to new diagnostic tools for early disease detection. Then, we will focus on two high profile problems in biomedical engineering research. The first one is cancer detection and diagnosis and what engineering approaches can do to help. The second focus area will be challenges in detecting, diagnosing and managing diseases in the developing world. Both of these case studies will focus on the problem, challenges, opportunities and long-term impact of engineering on human health, both at home and abroad.

Required Text: Emperor of All Maladies by Mukherjee.

Additional texts will be posted on blackboard.

I. Assignments:

1. 2 papers (choose one from each category)

Category 1 – Due on Wed March 6th.

1. Cancer detection in 2050: what would you like to see?
2. You have 1billion to cure cancer, what do you do?

Category 2 – Due on Monday April 1st.

1. Why should we care about cancer in the developing world?
2. What devices should Gates Foundation fund?

2. Homework assignments
3. Final assignment on design and analysis of a device for global health

II. Lecture Schedule

1. Mon, Feb 25: Biomedical Engineering: Why?
Readings: Biomedical Engineering for Human Health, The Social Responsibility of the Scientist
2. Wed, Feb 27: Quantitative tools for human health: The governing principles.
Readings: Chapter from Principles of Biomedical Engineering
3. Mon, March 4: Spectrum of quantitative engineering tools for human health: From nano to macro, from fundamental to applied.
4. Wed, March 6th: Cancer and Biomedical engineering : Hallmarks of cancer Readings: Hallmarks of Cancer; Molecular bioengineering and cancer
5. Mon, Mar 18: Cancer and Biomedical engineering: Technology, data, systems and hubris.
6. Wed, Mar 20: Cancer and Biomedical engineering: How to find a cure?
7. Mon, March 25: Beyond Boston: The big picture and challenges in global health. Is cancer relevant?
Readings from Biomedical Engineering for Global Health

8. Wed March 27 Diagnostics versus management
9. Monday April 1st. Biomedical engineering and Global Health: Translation from lab to village.

III. Labs

Week 1:

Lab 1: Intro to quantitative microscopy

Lab 2: Intro to fluorescence imaging

Week 2:

Lab 1: Cell culture fundamentals

Lab 2: Antibody tagging and detection

Week 3:

Lab 1: End point adhesion/ migration experiment 1

Lab 2: Time-lapse microscopy of cell migration.

Week 4:

Lab 1: Image analysis

Lab 2: Data analysis contd., literature comparison and error propagation

From a big picture perspective, labs in the Sophomore class (Spring term) are designed to:

- 1) Emphasize the importance of careful experimentation and analysis.
- 2) Introduce basic lab safety skills with regards to biological materials.
- 3) Develop a familiarity with biomedical instrumentation and measurement and limitations of various experimental techniques in providing quantitative information.

Through the lab, we expect *all* students to:

- 1) Perform experiments in triplicate and understand the statistical significance of multiple experiments.
- 2) Analyze results quantitatively.
- 3) Compare results with control experiments and discuss results in light of existing literature.

Experimental studies: The goal of the lab is for students to understand quantitatively how cancer cells migrate and to analyze their results by comparing their findings to values reported in published scientific literature. Students will perform the lab tasks in the following sequence:

- a) Students, who will be working in groups, will be provided cancer and non-cancerous cell lines and introduced to basic techniques of cell culture.
- b) Student teams will measure cellular proliferation rate by measuring the doubling time of cells *in vitro*.
- c) Students will be introduced to basics of microscopy and will familiarize themselves with the workings of a fluorescence microscope.

- d) Student teams will then stain the cells with a fluorescent dye and will be required to analyze the toxicity of the dye.
- e) Each team will carry out time-lapse imaging of cells and analyze the results in terms of spatial and temporal behavior of cancerous and non-cancerous cells.
- f) Each student, in his/her report, will be required to quantify the results, provide standard deviation and discuss the sources of error, both random and systematic, in his/her analysis.
- g) Each student will compare the findings of his/her team with previously published data on these cells and provide a critical analysis of how and why their results agree or disagree with previous findings.
- h) Finally, students will be required to discuss why this approach may or may not have any relevance to cancer research in general, and for finding the cure for cancer in particular.
- i) The students will also be required to argue, given the current economic crisis, whether the federal government should continue to support cancer research or use its limited resources elsewhere.

Unit 3 - Prof. Jonathon Simon – School of Public Health: Burdens, Bugs, Behaviors, Budgets, and the Bosses (organizations): The Case of Malaria Control in Modern Times

Malaria, an infectious disease we have known about for over 4000 years, still kills almost 660,000 people per year (WHO estimate 2010). Other scientists (Murray, C. *et.al.*) report the deaths are double the WHO estimate. All agree, however, that most of these deaths are in children in low-and-middle income countries. Efforts to control the global scourge of malaria provide a fascinating case study to begin to appreciate the approaches, complexities, and challenges of global public health scholarship and practice.

Improving the health of populations --- the core mission of Public Health both as a science and as a profession --- requires its scholars and practitioners to deal with amazing complexity. By focusing on social change at a population rather than an individual level, insights and interventions require one to think as an interdisciplinary scientist across multiple scientific disciplines. Each has their own, and often differing, intellectual traditions and methodological approaches. And just to make it even harder, this systems thinking on an intellectual level has to be grounded within the crass, pragmatic world of organizational politics and financial constraints because the burdens of disease seem always greater than the available budgets.

This unit, using the current global malaria control efforts as a case study, will take you on a whirlwind tour of how public health challenges are conceptualized and addressed. We will explore the importance of drawing contributions from history, epidemiology, biology, clinical medicine, political economy, economics, political science, evaluation sciences, and ethics. The challenge for the student, mirroring the challenges faced by public health professionals, is to collate, evaluate, integrate, and synthesize the essential information each discipline brings to the problem in order to maximize attaining the social goal of improving the health of populations. Hang on...Good Luck...and enjoy the intellectual journey.

I. Specific Objectives

1. Introduce seminar participants to public health approaches to inquiry.

2. Using global malaria control as the case study throughout the course, deepen seminar participants understanding of, and appreciation for, interdisciplinary approaches to scholarship and problem solving.
3. Deepen participants understanding of the complexities of public health (and most other) problems and foster an appreciation for thinking about systems approaches rather than disciplinary approaches.

II. Assignments: This unit will be assessed based on 3 domains - your engagement with the material and the other participants in the seminar, a critical book review on a readable book length piece of scientific journalism on malaria, and a final paper, based on a practical problem in global malaria control, synthesizing the course materials.

1. Engagement in Class (20%)
 - a. Class Participation (10%)
 - b. Contribution to Discussion Section Activities (10% - assessed by Teaching Assistant)
2. Paper 1 – Critical Book Review (30%): Please submit a 3-page critical book review. Seminar participants will read *The Fever* by Sonia Shah. Book reviews will be due at the start of the 4th week of the module (April 22rd).
3. Paper 2 – Final Paper (50%)- Seminar participants will receive a problem statement posted on the course website after the April 24th lecture. Please submit a 5-page paper addressing the problem using an interdisciplinary approach to synthesize the course materials. Final papers will be due on Friday, May 3rd.

III. Lecture Schedule

Week 1: Importance and History of Malaria

Wednesday, April 3st – Introduction to the course and the historical importance of Malaria

Learning Objective(s): Understand course module objectives, format, expectations, and assessments. Understand the important of malaria as a global scourge historically and currently.

Readings: *The Fever* by Sonia Shah (Chapters 1-4)

Friday, April 5th – Discussion: TBD

Week 2: The Analytic and Biologic Science of Malaria

Monday, April 8th – Malaria Epidemiology: Burden and Patterns of Disease

Learning Objective(s): Understand the magnitude, distribution, and patterns of malaria morbidity and mortality. Know the primary at-risk sub-populations and comprehend the importance of ecology and climate.

Readings: WMR 2012 Chapters Summary and 8. *The Fever*, through chapter 8.

Lancet editorial on Chris Murray paper

Chris Murray critique of WHO estimates in *Lancet* 2012 (Both these papers are in the KHC Spring 2013 folder. They are legally accessible to our students so link them in the course Blackboard site

Wednesday, April 10th – Human and Vector Biology for Malaria Control and Elimination. Lecture by Dr. Chris Gill

Learning Objective(s): Understand the basic principle of the infection cycle in humans and how it relates to disease and vaccine development. Understand the basics of vector biology, different *anophelene* species, and the importance of understanding changing vector biology

Readings: TBD

Friday, April 12th – Discussion: TBD

Week 3: The Applied Sciences of Malaria Control and Elimination

Wednesday, April 17th – Public Health Interventions for Malaria Control and Elimination

Learning Objective(s): Understand the strengths and weaknesses of the public health tools used to control malaria.

Readings: WMR 2012 Chapters 2 4 and 5.

Thursday, April 18th – The Diagnosis and Clinical Case Management of Malaria. Lecture by Dr. Kojo Yeboah-Antwi

Learning Objective(s): Understanding how to diagnose and treatment malaria and how clinical case management has changed over the past twenty years. Review the importance of drug and insecticide resistance in altering clinical case management.

Readings: WMR 2012 Chapter 6 and TBD.

Complete *The Fever*.

Friday, April 19th – Discussion: TBD

Week 4: Problem 2: The Organizations, Politics and Money of Malaria Control and Elimination

Monday, April 22nd – Global Malaria Organizations – Complementarities and Conflicts among the Alphabet Soup of Malaria Organizations.

Learning Objective(s): Know the major players in the global malaria response, their missions, and their priorities. Understand potential sources of complementarities and conflict.

Readings: Review the home pages and mission statements of at least three global malaria programs. Possible websites are listed below.

Book review is due by 9am on April 22nd.

Wednesday, April 24th – Global Financing for Control and Elimination and the Economics of Malaria

Learning Objective(s): Understand the magnitude, sources and shortfall of global malaria financing. Understand the perceived importance of the private sector and the “business case” for malaria control.

Readings: TBD and RBM Progress and Impacts Series piece *Business Investing in Malaria Control: Economic Returns and a Healthy Workforce for Africa* (URLs below)

<http://www.rbm.who.int/ProgressImpactSeries/report6.html>

<http://www.rbm.who.int/ProgressImpactSeries/docs/report6-en.pdf> pp 9-24 and 41-43

Friday, April 26th – Discussion: TBD

Week 5:

Monday, April 29th – The Future of Malaria: Control and/or Elimination,

Learning Objective(s): Understand the global discussion over the Roadmap to Eradication and how the world will find a balance between high-level sustained control in areas of high transmission intensities and efforts to “grow the map” of elimination in areas of lower transmission intensity.

- Readings: TBD and Malaria Elimination 1: Shrinking the Malaria Map: progress and prospects. Feachem R. et.al. *Lancet* 2010 Vol 376 1566 – 1578
<http://www.ncbi.nlm.nih.gov.ezproxy.bu.edu/pmc/articles/PMC3044848/pdf/main.pdf?tool=pmcentrez>

Wednesday, May 1st – Scientific Challenges, Ethical Dilemmas and the Way(s) Forward

Learning Objective(s): Know the outstanding scientific challenges, engage with the ethical dilemmas and enjoy my attempt to summarize the complexity and interdisciplinarity of malaria control and elimination as an example of public health thinking

Readings: No readings as **final paper is due by noon on Friday, May 3rd.**

Readings and Resources:

Seminar participants will be exposed to four types of information on malaria -(reputable) web sites, scientific papers, institutional reports, and science journalism. Participants will be expected to read from all four sources and engage in class and section discussions. Required readings will be posted on the course Blackboard site while a wealth of information is available on the websites listed below.

2) (Reputable) Web Sites

- World Health Organization (WHO) Malaria site <http://www.who.int/topics/malaria/en/>
- WHO 2012 World Malaria Report: <http://bit.ly/U8BXgv>
- Roll Back Malaria site <http://www.rbm.who.int/>
- Centers for Disease Control (CDC) Malaria site <http://www.cdc.gov/malaria/about/index.html>
- President's Malaria Initiative (PMI) site <http://www.fightingmalaria.gov/> or <http://www.pmi.gov/about/index.html>
- Global Fund for AIDS, TB and Malaria site <http://www.theglobalfund.org/en/about/diseases/malaria/>
- Bill and Melinda Gates Foundation Malaria site <http://www.gatesfoundation.org/topics/Pages/malaria.aspx>
- <http://www.healthmetricsandevaluation.org/tools/data-visualization/deaths-due-malaria-age-and-country-mapped-over-time-global-1980-2010#/overview/explore>

3) Scientific Literature

- Malaria. Greenwood, Brian et.al. *Lancet* 2005 Vol 365 1487-1498
http://ac.els-cdn.com/S0140673605664203/1-s2.0-S0140673605664203-main.pdf?_tid=98d8510e91cbc2dffca4da6a0f44a4b5&acdnt=1332887330_0e03eeb791a143c410a19e8833fb0ef9
- Global malaria mortality between 1980 and 2010: a systematic analysis. Christopher J L Murray, Lisa C Rosenfeld, Stephen S Lim, Kathryn G Andrews, Kyle J Foreman, Diana Haring, Nancy Fullman, Mohsen Naghavi, Rafael Lozano, Alan D Lopez *Lancet* 2012 Vol. 379 413-431
http://ac.els-cdn.com/S0140673612600348/1-s2.0-S0140673612600348-main.pdf?_tid=aff2ad9ab79c69f8ff03497a70c25db4&acdnt=1332887686_b469abd8a5131c652eba53e66fad3def
- A new global malaria eradication strategy. Feachem R, Sabot, O. *Lancet* 2008 Vol. 371 1633-1635. http://ac.els-cdn.com/S0140673608604249/1-s2.0-S0140673608604249-main.pdf?_tid=6043c5bbf6f293259dbdeb68ae90a26a&acdnt=1332891541_e8f9627b9d2e9cafe87eb3674ff7a0bb
- Malaria Elimination 1: Shrinking the Malaria Map: progress and prospects. Feachem R. et.al. *Lancet* 2010 Vol 376 1566 - 1578
<http://www.ncbi.nlm.nih.gov.ezproxy.bu.edu/pmc/articles/PMC3044848/pdf/main.pdf?tool=pmcentrez>
- Malaria Elimination 2: Ranking of elimination feasibility between malaria endemic countries. Tatem, A. et.al. *Lancet* 2010 Vol 376 1579 - 1591.
<http://www.ncbi.nlm.nih.gov.ezproxy.bu.edu/pmc/articles/PMC3044847/pdf/main.pdf?tool=pmcentrez>
- Malaria Elimination 3 : Operational strategies to achieve and maintain malaria elimination. Moonen, B. *Lancet* 2010 Vol 376 1592 - 1603.
<http://www.ncbi.nlm.nih.gov.ezproxy.bu.edu/pmc/articles/PMC3037542/pdf/main.pdf?tool=pmcentrez>
- Malaria Elimination 4: Costs and financial feasibility of malaria elimination. Sabot, O. et.al. *Lancet*. 2010 November 6; 376(9752): 1604-1615.
<http://www.ncbi.nlm.nih.gov.ezproxy.bu.edu/pmc/articles/PMC3044845/pdf/main.pdf?tool=pmcentrez>

4) Scientific Journalism

The Fever. Sonia Shah. Sarah Crichton Books, Farrar, Straus and Giroux: New York. 2010.

5) Institutional Reports:

- *World Malaria Report 2012*. World Health Organization. WHO: Geneva. 2012 (url: http://www.who.int/malaria/publications/world_malaria_report_2012/en/)
 - *A Decade of Partnership and Results*. Roll Back Malaria. WHO: Geneva. 2011. (url: www.rollbackmalaria.org/ProgressImpactSeries/docs/report8-en.pdf)
 - *The President's Malaria Initiative: Sixth Annual Report to Congress*. USAID: Washington, D.C. 2012. (url: www.pmi.gov/resources/reports)
 - External Evaluation of the President's Malaria Initiative 2012. Simon JL. et.al. http://www.pmi.gov/news/docs/audit_fullreport.pdf
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