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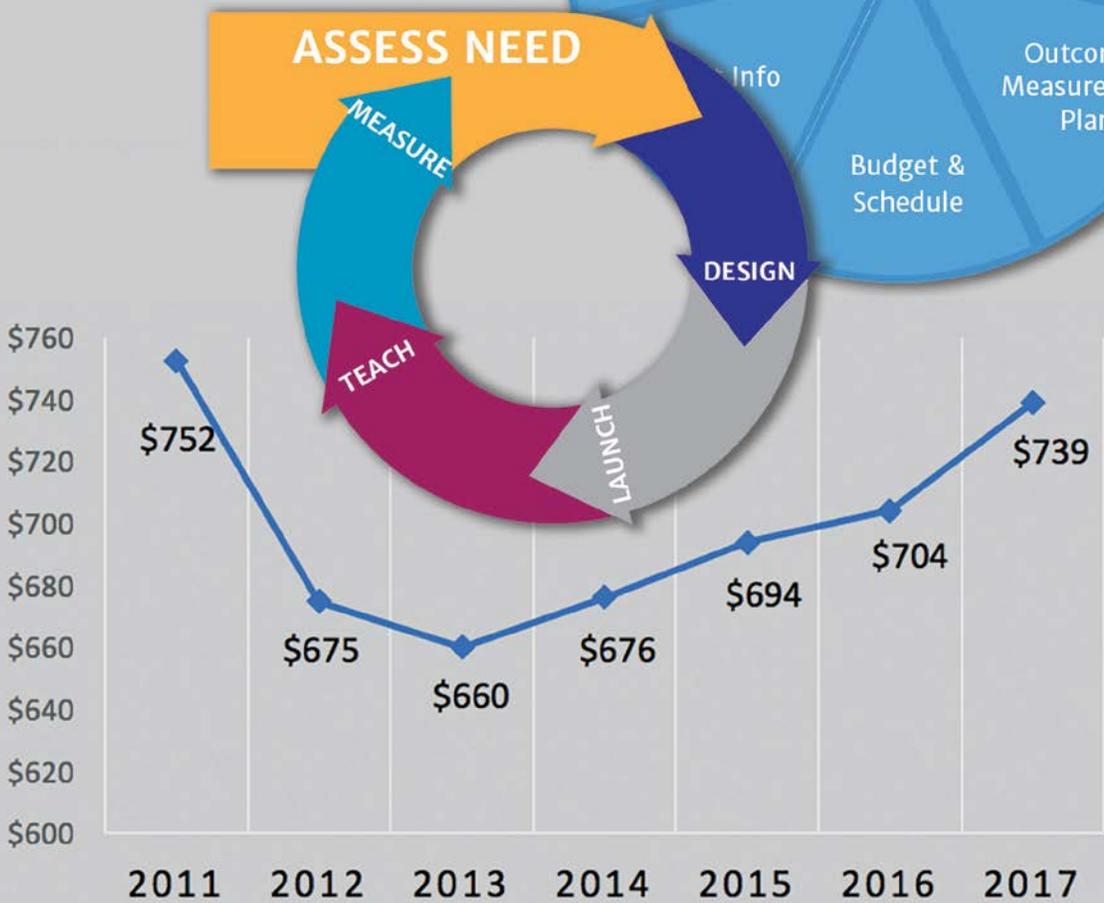
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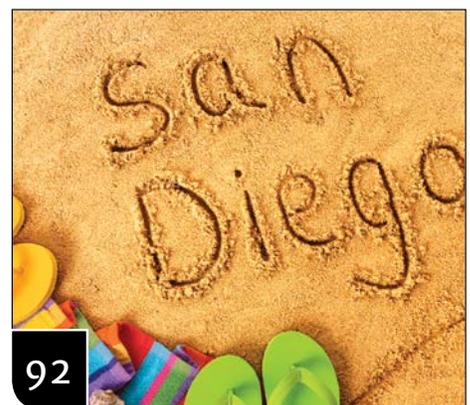
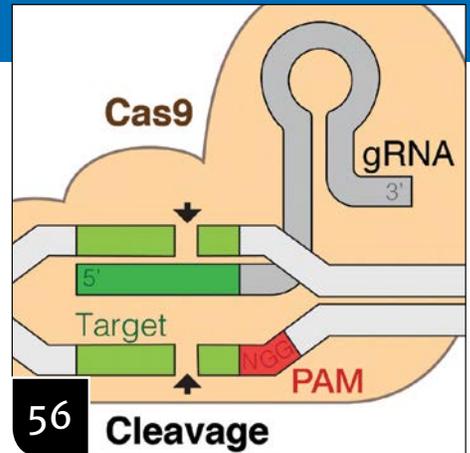
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Worst Practices for Writing CME Needs Assessments: Results From a Survey of Practitioners

Donald Harting, MA, MS, ELS, CHCP¹; and Andrew Bowser, ELS, CHCP²

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This original research article examines ways to improve the quality and clarity of NAs. It is being published simultaneously by the Alliance for Continuing Education in the Health Professions (Alliance) in the Almanac and by the American Medical Writers Association (AMWA) in the AMWA Journal. To provide context and interpretation of the research results pertinent to their respective readers, both publications have solicited commentaries from their audience to accompany the main article.

ABSTRACT

Background and Aims: Needs assessments (NAs) are commonly developed to identify gaps in the knowledge, competence, performance, and confidence of health care providers and to guide the development of continuing education activities designed to remedy these deficiencies. Although best practices of NA development have been thoroughly described, little work has been done to evaluate poor or unprofessional practices that may compromise their value or validity. We sought to describe these practices with a survey primarily targeted toward individuals who develop NAs.

METHODS

Respondents to an annual survey were prompted to describe unprofessional or poor practices that they had observed in NAs developed by other writers. Responses were categorized by 2 independent reviewers.

RESULTS

A total of 104 individuals submitted responses to the survey. Of those, 67 included write-in responses describing poor practices. The most common poor practices were related to sources and referencing (19 responses), whereas other commonly cited poor practices included irrelevance or poor focus; organization, coherence, and readability issues; and plagiarism,

fabrication, or bias. Specific quotations from write-in responses are provided in this article.

CONCLUSION

Despite available resources that outline and teach best practices in writing CME NAs, writers continue to struggle with referencing, organization, coherence, and readability. This may present an opportunity for the industry to consider new best practices that would encourage standardization and eliminate some of the poor practices described here.

We have been conducting a multiyear research project aimed at identifying best practices in writing and editing needs assessments (NAs) for continuing education in the health professions, including continuing medical education (CME). Compliance criteria promulgated by the Accreditation Council for Continuing Medical Education (ACCME) require all accredited CME providers to design educational activities to address deficits in knowledge, competence, or performance that underlie professional practice gaps.¹ Needs assessments are widely used by publishing and education companies within the accredited CME system to identify these deficits. For example, an assessment of need typically appears as a single section within a larger request for commercial support submitted to 1 or more pharmaceutical companies (Figure 1). The task of developing the NA often falls to an in-house or freelance medical writer, whereas proposal assembly, editing, and submission are usually handled by staff employees. As commercial support increases within the ACCME system (Figure 2), so does the number of NAs required to support a growing number of funding requests. Needs assessments can vary in length from less than a page to more than 10 pages depending on the number of gaps, the quantity of supporting evidence, and the resources available.

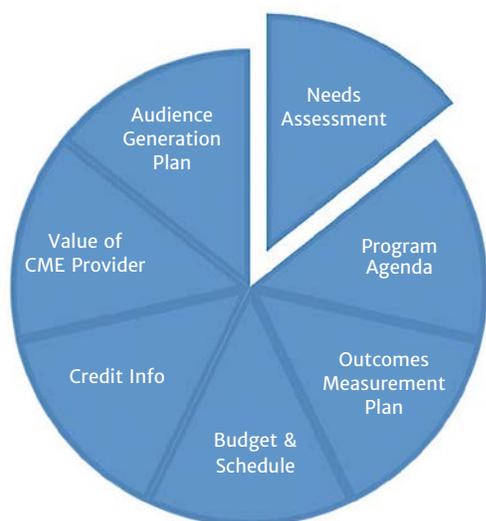


Figure 1. Components of a typical CME grant proposal. CME, continuing medical education.

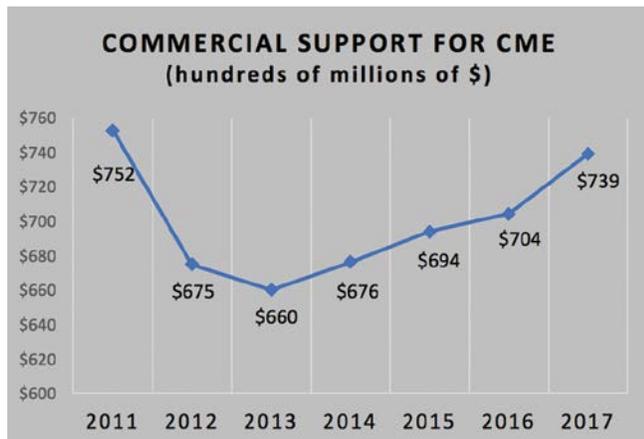


Figure 2. Growth of commercial support for accredited CME. CME, continuing medical education. (Source: Accreditation Council for Continuing Medical Education)

Our research into best practices in NA development originated in 2011 with a small pilot study analyzing a convenience sample of NAs written by various authors and collected from several sources, including a roundtable conducted at a freelance writers conference hosted by the Delaware Valley Chapter of AMWA. A considerable amount of variation was noted in the sources of evidence used in these NAs, how the evidence was presented, and how it was cited. Unwarranted variation in a health care–related process can be a sign of poor quality^{2,3} and, as stated in the professional literature,⁴ effective continuing education begins with a high-quality NA (Figure 3). Thus, we sought to explore this variation further in surveys targeted to writers of NAs.

These surveys have been conducted annually since 2014 for a total of 5 surveys to date. We have previously published posters,⁵⁻⁸ workshop slide decks,^{9,10} a journal article,¹¹ and a

downloadable tutorial¹² disseminating best practices. In 2018, for the first time, survey respondents were invited to describe any poor or unprofessional practices they had noticed in NAs written by others. This article presents our first discussion of “worst practices,” based on analysis of those write-in responses.

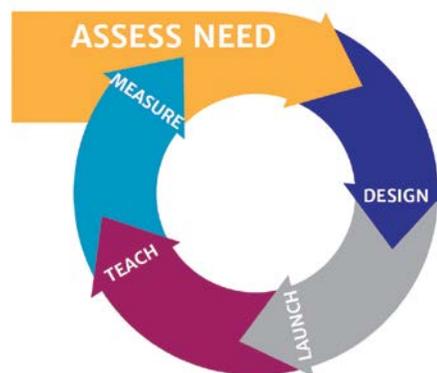


Figure 3. The continuing education cycle. (Graphic courtesy of AMWA Journal.)

METHODS

The fifth annual survey of best practices for writing CME NAs was developed in SurveyMonkey and promoted to fellow members of AMWA and the Alliance mostly via Twitter and LinkedIn, between October 5 and 19, 2018. The survey link was also sent via email to previous years’ respondents and to anyone else within the authors’ professional networks who had written at least several NAs and expressed interest in the past year. In addition, AMWA, the Delaware Valley Chapter of AMWA, and the Mid-Atlantic Alliance for CME helped promote the survey to their members.

The first 2 questions of the survey provided us with demographic data, and most of the other questions were designed to capture data on best practices of NA development. One open-ended question was included to elicit responses on worst practices: “What unprofessional or poor practices, if any, have you noticed while reviewing needs assessments written by others that might be appropriate for future survey research?” Responses to this question were entered into a spreadsheet and provided to 2 reviewers, including a past President of the Alliance (Robert L. Addleton, EdD, [Reviewer 1]) and the current President of AMWA (Cynthia L. Kryder, MS [Reviewer 2]). The reviewers were unknown to each other and worked separately to sort the 67 responses into categories defined for them in advance (Table 1). In cases in which a survey respondent combined ≥ 2 poor practices into a single response, the reviewers were instructed to select the category that best described the most salient problem.

Table 1. Worst Practices Sorted Into Categories

	Reviewer 1	Reviewer 2
Grammar Issues	4	2
Sources and Referencing	19	19
Outdated Information	7	4
Organization, Coherence, and Readability Issues	11	14
Plagiarism, Fabrication, and Bias	10	9
Irrelevance or Poor Focus	13	15
Other	3	4
TOTAL	67	67

RESULTS

A total of 104 survey responses were received. Respondents were roughly balanced between freelances (50%) and staff employees (44%), with freelances in the slight majority (Figure 4).

More than half of respondents (60%; N=104) had written at least 26 NAs in their careers; 44% had written more than 50. A total of 67 responses described poor practices. Some responses were simple and focused on a single poor practice, such as “gap statements that are not supported by evidence.” Other respondents included multiple poor practices, such as “poor grammar/formatting, poor narrative structure, too much industry influence, lack of educational outcomes data or heavy reliance on outcomes data at the expense of current science.” The spreadsheet with all 67 responses can be found in the [Online-Only Exclusive](#). Results as sorted by the 2 reviewers are shown in Table 1.

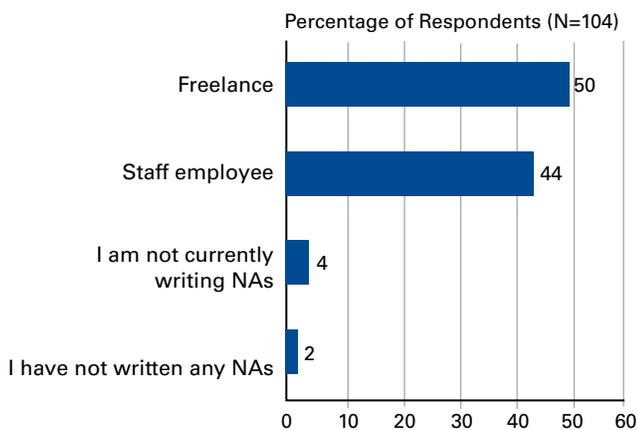


Figure 4. Breakdown of freelances compared with staff employees among survey respondents.

The following verbatim responses are illustrative:

1. “Atrocious grammar!” (Grammar Issues)
2. “Insufficient references,” “Lack of citation,” and “Not having strong enough support for gaps in education” (Sources and Referencing)

3. “Cites outdated research or fails to acknowledge new developments that discredit previous findings” (Outdated Information)
4. “Poor writing skills, e.g., organization, crafting sentences” (Organization, Coherence, and Readability)
5. “Plagiarism,” “Spinning the NA to favor the potential grantor’s product,” “Making up faculty quotes, making up outcomes data” (Plagiarism, Fabrication, and Bias)
6. “Data dump that does not get to the actual gaps in clinical practice or why there is an unmet need” (Irrelevance or Poor Focus)
7. “Lack of examination of clinician attitudes/beliefs” (Other)

DISCUSSION

This article briefly describes our first-ever analysis of worst practices in NA development in the 5+ years that we have been researching this topic. The most commonly cited problem involved sources and referencing. In 4 out of 5 previous years’ surveys, respondents have reported that the medical literature review is the most essential source of evidence in the NA. Because the heart of any literature review is the reference list, deficits in sources and referencing may suggest an inexperienced, rushed, or sloppy writer has had trouble finding valid data, identifying sources, or compiling the reference list in a clear and orderly manner. These are all problems that the reader may notice if an editor does not identify and correct them. Conversely, even skilled and experienced medical writers may underperform if given too little lead time, low-quality templates to follow, or vague editorial direction.

In either case, a skilled and meticulous researcher who is able to work quickly and effectively with a client to overcome obstacles, identify a bona fide educational need, and marshal detailed evidence to support it adds great value to the process. For this reason, a face-to-face workshop or online exercise aimed at mastering the skill of conducting a high-quality literature review may be helpful. Based on survey respondents’ comments, this workshop could also include instruction on proper appraisal of clinical study results, along with tips for extracting relevant data and using them to support statements of educational need. A separate workshop, aimed at assigning editors, medical directors, and other individuals who hire freelance writers, may also be useful; this session might include instruction on ways to work more effectively with freelance medical writers, and topics might include facilitating 2-way communication, setting reasonable deadlines, providing editorial direction and support, and incorporating evidence-based best practices into proprietary templates.

Reports of plagiarism, fabrication, and commercial bias are troubling, given past efforts by the ACCME, the US Congress, the Josiah Macy Jr. Foundation, the Institute of Medicine, and

other stakeholders to protect the integrity of continuing education in the health professions.¹³ Independence is the cornerstone of accredited continuing education; without it, clinicians lose their ability to teach and learn free from commercial influence.¹⁴ Thus, in light of our findings, it would appear that the ACCME's current effort to revisit this issue is necessary and timely. Spot-checking of a random sample of CME NAs would be illuminating and represents a potential further avenue for research.

There are several limitations to this study. First, this was not a random sample of writers. The respondent pool may have been biased toward members of the investigators' professional networks, most of whom live in the eastern United States. Unlike in the prior year, the 2018 survey link was not promoted by the Alliance staff to members nationwide, so the respondent pool may also be biased in favor of AMWA members. Second, the fact that reviewers could only assign a single category to a lengthy response containing ≥ 2 poor practices introduced an extra measure of subjectivity to the analysis. Third, the fact that only 2 reviewers were recruited makes it difficult to interpret the significance of the remarkable similarity of their analyses. Fourth, the survey contained only a single question about poor practices; as a result, we obtained descriptive examples of poor practices but did not delve deeper to identify reasons behind the poor practices or inquire about ways to address them. Fifth and finally, we obtained secondhand observations of problems noted by respondents at some point in the past; accuracy would have been greater if we had audited a random sample of NAs.

These limitations notwithstanding, some inferences may be drawn. Both reviewers were invited to submit comments. In a note accompanying her review, Ms. Kryder wrote,

“Despite available resources and hands-on workshops that describe best practices in writing CME needs assessments, these survey data show that writers continue to struggle with referencing, organization, coherence, and readability. This presents an opportunity for the CME industry to adopt a structured template that writers can use when developing needs assessments, similar to templates already in use in the regulatory writing setting. Such standardization may eliminate some of the poor practices...and enable writers to more successfully develop an organized and readable narrative that identifies educational gaps that are clearly supported by evidence.”

Author declarations and disclosures: The authors note no commercial associations that may pose a conflict of interest in relation to this article.

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Commentary

Lori L. Alexander, MTPW, ELS, MWC / AMWA Education Director

Harting and Bowser are to be commended for their continued surveys on best practices—and now worst practices—for writing needs assessments for continuing medical education (CME) activities. It is indeed distressing to see the nature of the most common worst practices, as they relate to fundamental skills in writing a needs assessment (the literature review) or in writing itself (organization, focus). In looking for a bright spot, I was encouraged to see that the least common issues were related to grammar.

SOURCES AND REFERENCING

More than a quarter of the open-ended responses on worst practices were related to Sources and Referencing. As faculty for a university-level certificate program in medical writing, I can attest to the reality of this worst practice. I and my colleagues have been surprised to find that students—primarily postdoctoral researchers—do not cite sources appropriately.

According to the 67 responses in the present study, it seems that most of the problems were related to a lack of appropriate references, that is, not including references to guidelines, not citing original sources, not providing references that accurately support the practice gap, and citing older references. These problems indicate a higher-level issue: a gap in knowledge regarding the most appropriate data sources for needs assessments. Taken together, the poor practices in this category point to the need for enhanced education focused on the basics of citing references as well as on how to conduct a high-quality literature review that supports a practice gap and the need for education.

ORGANIZATION AND FOCUS

After Sources and Referencing, the next 2 most common categories of poor practices were Irrelevance or Poor Focus, representing 19% to 22% of the comments, and Organization, Coherence, and Readability, accounting for 16% to 21% of the comments. Poor practices in these categories are especially troubling because impeccable writing skills is the primary requirement of all medical communicators. Every writer, regardless of the setting, must know that the initial steps in any writing project are to define the audience and the purpose, and these steps lead the pathway to determining the appropriate level of information needed in a document. Medical communicators in the CME setting must be able to craft a needs assessment that is unfettered with irrelevant information and focuses on the key message readers need to know to make decisions.

WHAT WE DON'T KNOW

At the same time that the open-ended responses highlight educational needs, much remains unknown or unclear. For example, the authors acknowledge the limitation of “second-hand observations of problems noted by respondents at some point in the past,” and this limitation is compounded by our lack of knowledge about the experience of the writers with poor practices. It's likely that the level of experience does not reach that of the survey respondents, 45% of whom had written more than 50 needs assessments. One would think that the more needs assessments a writer develops, the more skilled he or she becomes. If the problem is among beginning writers, we can enhance skills through fundamental education on writing needs assessments. However, we need a different tactic if this problem is occurring among more experienced practitioners.

Another unknown is the type of plagiarism identified by respondents. In scientific manuscripts, self-plagiarism is the most common type of plagiarism,¹ but that type is unlikely to be the offender in needs assessments. What was the most common type of plagiarism in the CME setting? Was the plagiarism egregious, with full sections of text lifted directly into the needs assessment? Or was the problem with paraphrasing and no citation? Or was it source based, with writers referencing an incorrect source or referencing a secondary source but citing only the primary source? Citing secondary or tertiary sources rather than primary ones was noted in the open-ended responses, but these responses may not have been identified by the reviewers as plagiarism. Knowing the type of plagiarism can help us target education to enhance knowledge and skills in citing sources appropriately as well as in the importance of interpreting the literature in order to create original statements.

Lastly, we need a clearer picture of the poor practices. As Harting and Bowser note, assigning only a single category to a list of problems in one response was a limitation to the study. If we list all of the problems separately and then assign specific categories, we can better identify and target educational needs. I encourage the authors to take this next step in analyzing the data.

MOVING FROM WORST TO BEST

As I work to enhance AMWA's development of education based on documented needs, I applaud Harting and Bowser's effort to identify deficiencies in medical communicators' practices. The survey responses provide a data source that can help AMWA direct the creation of education in preparing CME activities.

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Gene Therapy and Gene Editing: Where Are We?

Elise Eller, PhD / Whitsell Innovations, Chapel Hill, NC

ABSTRACT

CRISPR and chimeric antigen receptor (CAR) T-cells are frequently mentioned in the news, but what are they? CAR T-cell therapy is a type of gene therapy, while CRISPR is a gene editing tool. To put CRISPR and CAR T-cell therapy into context, we need to understand the fundamentals of gene therapy and gene editing. While gene therapy is used to augment a defective gene, gene editing changes DNA in its native location. Both gene therapy and gene editing require delivery mechanisms such as viral vectors to deliver the therapeutic elements to target cells, and delivery can occur either in vivo or ex vivo. To date, a handful of gene therapies are approved in the world, including 3 gene therapies approved in the United States (2 of which are CAR T-cell therapies). No gene editing-based therapies have been approved anywhere in the world, although research is ongoing in preclinical studies, animal models, and clinical trials. There are potential problems with both gene therapy and gene editing. In particular, a major concern for CRISPR-based approaches is the potential for off-target effects. There are also ethical concerns regarding gene editing of germline cells, which would affect the DNA of an individual's progeny. In spite of the problems with gene therapy and gene editing, both gene therapy and gene editing offer potential solutions for a variety of diseases.

Targeting DNA via gene therapy or gene editing to manage disease has become a hot topic. CRISPR (clustered regularly interspaced short palindromic repeats)—an inexpensive, efficient, and versatile gene editing tool—is of particular interest, and the report in November 2018 of the birth of 2 babies with CRISPR-edited DNA has amplified the discussion of gene editing and its place in the therapeutic space.¹ But what are gene therapy and gene editing? In this article, I summarize the underlying science of gene therapy and gene editing and describe the current state of research on therapeutics that target DNA.

GENE THERAPY AND GENE EDITING AS THERAPEUTICS

When we consider DNA-targeting therapeutics, we need to recall the fundamentals of the role of genetics in disease. Genes are coded by DNA in the cell nucleus. A gene's DNA is transcribed into RNA, which is then transported into the cell cytoplasm and translated into proteins. This 2-step process is known as the central dogma of molecular biology. A mutation in the DNA may result in a nonfunctional or dysfunctional protein, causing disease.

When we think about therapeutic drugs, we mostly think about drugs that target proteins (Figure 1). However, therapeutics can also target RNA or DNA. It is in this space that gene therapy and gene editing operate. Gene therapy and gene editing are used to circumvent genetic mutations that result in nonfunctional or dysfunctional proteins.

There are 2 types of situations in which we might want to target DNA to manage disease:

- **Monogenic disorders:** Monogenic disorders are disorders caused by a defect in a single gene. Thousands of monogenic disorders have been described in humans (eg, cystic fibrosis, thalassemia, and Huntington's disease). Collectively, these disorders affect millions of people. Some of these disorders are very rare, and the majority have no cure and no treatment.
- **Cancer:** Cancer is caused by mutations in somatic cells that allow the cell to grow uncontrollably. Restoring function to the mutated genes could control tumor growth and metastasis.

GENE THERAPY

Gene therapy is used to augment a defective gene but, in contrast to gene editing, does not remove or modify the mutated DNA sequence. In gene therapy, a vector is used to introduce nucleic acids (either DNA or RNA) into target cells with the intention of altering gene expression to prevent, halt, or reverse a pathologic process.² Viruses are often used as vectors because they have a natural ability to deliver genetic material into cells; the virus is modified to remove its ability to cause

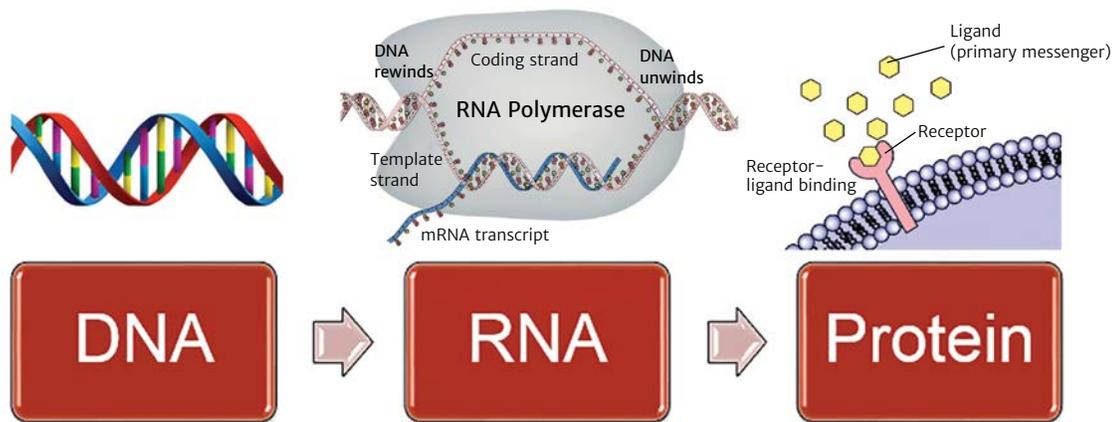


Figure 1. In the central dogma of molecular biology, DNA is transcribed into RNA, which is translated into protein. Most therapeutic drugs target proteins involved in disease, but therapies can also target DNA or RNA. *Left image adapted from <https://thecandidscientist.com/2015/06/02/dna-101/>; center image from <http://hyperphysics.phy-astr.gsu.edu/hbase/Organic/mrna.html>, adapted from <File:MRNA-interaction.png> (https://en.wikipedia.org/wiki/Messenger_RNA#/media/File:MRNA-interaction.png) https://commons.wikimedia.org/wiki/Commons:GNU_Free_Documentation_License,_version_1.2; right image excerpt from “What are receptor proteins?” (<https://www.quora.com/What-are-receptor-proteins>).*

an infectious disease. Commonly used viral vectors are retroviral vectors and adenoviral vectors, although other viral vectors can be used. The choice of vector depends on the purpose of the gene therapy. Retroviral vectors allow DNA to be integrated into the genome, resulting in the DNA being present in daughter cells. However, the problem of unwanted gene expression arises if the vector is inserted into the wrong place in the genome. With adenoviral vectors, DNA is not integrated into the genome. Instead, the DNA remains in the cell nucleus and is available to be transcribed into protein. As a result, the DNA is transient. This type of vector is best used in cell types that are no longer dividing.

Gene therapy can be delivered **in vivo** or **ex vivo**. In vivo gene therapy entails inserting the therapeutic gene into a vector and injecting or infusing the vector into the person to reach the target cells. For example, the vector and therapeutic gene might be injected into retinal cells to manage a genetic disease of the eye. Adeno-associated virus-derived vectors are preferred for in vivo gene therapy because they have a good safety profile.³ In contrast, ex vivo gene therapy uses the patient's own cells, which are removed from the person, modified, and then returned to the person. For example, if the disease is caused by a defective gene in a person's white blood cells, those white blood cells are removed from the individual, the functional genes in a vector are then transferred into the white blood cells, and the modified white blood cells are screened to make sure the gene has been transferred correctly into the white blood cells. These modified cells are then infused back into the individual. This method has better efficiency than in vivo gene therapy, and because it uses the patient's own cells, it is less likely to cause an immune response. However, not all cell types (eg, brain

cells, retinal cells) can be treated ex vivo, although there is some research with stem cells that could allow treatment of these cell types.

As with any therapy, there are potential problems with gene therapy:

- **Gene delivery and activation:** For some disorders, the therapeutic gene must be delivered to millions of cells. Also, the gene may be introduced into the wrong type of cell.
- **Immune response:** A reaction to the vector can result in serious illness. This can be avoided by ex vivo gene therapy.
- **Disruption of important genes in target cells:** The therapeutic gene might be inserted into genes that control cell growth and are then disrupted, potentially resulting in cancer.
- **Commercial viability:** There is a high cost to drug companies to develop therapies for rare disorders. Approved gene therapies cost on the order of hundreds of thousands of dollars for a single dose.^{4,5,6}

The world's first commercial gene therapy, Gendicine, was approved in 2004 in China for the management of head and neck squamous cell carcinoma in combination with radiotherapy. The first gene therapy approved in the European Union was Glybera for the management of lipoprotein lipase deficiency. The therapy was approved in 2012, but the sponsor allowed the marketing authorization to expire in 2017 because the therapy was a commercial failure—the therapy cost more than €1 million for a single dose—and the sponsor was not able to gain approval in the United States.⁷ Another gene therapy, Strimvelis, was approved in the European Union in 2016 for the management of severe combined immunodeficiency due to adenosine deaminase deficiency.⁸

In the United States, 3 gene therapies were approved in rapid succession in late 2017 (Table 1). The first 2 approved gene therapies, Kymriah⁹ and Yescarta,¹⁰ are chimeric antigen receptor T-cell therapies. The third gene therapy, Luxturna,¹¹ is the first gene therapy that targets a disease caused by mutations in a specific gene.

GENE EDITING

In contrast to gene therapy, gene editing changes DNA in its native location. Older gene editing approaches were based on ZFNs (zinc finger nucleases) and TALENs (transcription activator-like effector nucleases), which are proteins that must be engineered to cut DNA. However, these are time-consuming, have low efficiency, and have **off-target effects**. In contrast, gene editing via CRISPR has proved to be fast, efficient, and versatile. As a result, CRISPR technology has many potential applications, including in medicine.¹²

CRISPR gene editing technologies are derived from a gene editing system found in bacteria. The CRISPR gene editing complex comprises a synthetic guide RNA, which is designed to target a DNA sequence of interest (eg, the mutated gene in a patient), and a nuclease (eg, Cas9, Cpf1, or a modified Cas9 nuclease) that **cleaves** the target DNA at a specific location (Figure 2).

Once the target DNA is cut, the mutated gene can be revised, removed, or replaced (Figure 3).¹³ Revising (replacing a **nucleotide** that is causing the disease with a different nucleotide) or removing (removing a segment of DNA that is causing the disease) the mutated DNA results in knocking out the dysfunctional gene. In contrast, replacement results in restoring normal function to the gene. Replacement entails providing template DNA to replace a defective DNA sequence with the desired or correct sequence. In addition, CRISPR can be used to regulate genes, a process known as CRISPR interference. In this approach, one uses a “dead” version of Cas9, which eliminates CRISPR’s ability to cut DNA while preserving its ability to target DNA sequences, to turn a gene on or off or regulate its activity in a reversible fashion.

Like gene therapies, the CRISPR complex—and template DNA, if needed—can be delivered in vivo or ex vivo. Delivery can occur via viral or nonviral systems. Other delivery methods, such as lipid nanoparticles, are also being investigated.¹⁴

A major concern of CRISPR technologies is the possibility of off-target effects, in which the CRISPR gene editing tool cuts not only at its target site but also at unintended sites that have similar DNA sequences. The risk of off-target effects can be controlled to some degree with the design of guide RNA and

Table 1. Gene Therapies Approved in the United States

Therapy and Sponsor	Initial Approval Date	Indication(s)	Comments
Kymriah (tisagenlecleucel) ⁹ Novartis	August 2017	<ul style="list-style-type: none"> Refractory or relapsed B-cell precursor ALL in patients ≤25 years old Relapsed or refractory large B-cell lymphoma in adults 	<ul style="list-style-type: none"> CAR T-cell therapy Boxed warning for CRS and neurologic toxicities REMS in place
Yescarta (axicabtagene ciloleucel) ¹⁰ Kite Pharma/Gilead	October 2017	<ul style="list-style-type: none"> Relapsed or refractory large B-cell lymphoma in adults 	<ul style="list-style-type: none"> CAR T-cell therapy Boxed warning for CRS and neurologic toxicities REMS in place
Luxturna (voretigene neparvovec-rzyl) ¹¹ Spark Therapeutics	December 2017	<ul style="list-style-type: none"> Inherited form of retinal dystrophy (vision loss that can result in blindness) 	<ul style="list-style-type: none"> First in vivo therapy gene in the United States

ALL, acute lymphoblastic leukemia; CAR, chimeric antigen receptor; CRS, cytokine release syndrome; REMS, Risk Evaluation and Mitigation Strategy.

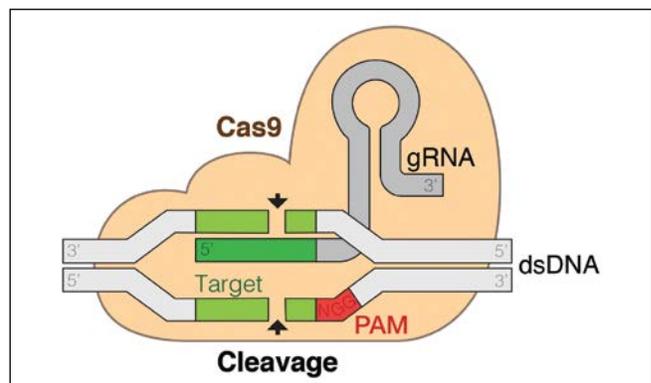


Figure 2. The CRISPR/Cas9 gene editing complex comprises a nuclease such as Cas9 (tan) and a synthetic gRNA (dark gray and green) designed to target a DNA sequence of interest (light green)—for example, a mutated gene in a patient. Once the gRNA has bound to the target DNA sequence, Cas9 cleaves the target DNA. Cas9, an enzyme (nuclease) that cuts DNA; dsDNA, double-stranded DNA; gRNA, guide RNA; PAM, protospacer adjacent motifs. Image courtesy of Marius Walter via Wikimedia Commons. <https://commons.wikimedia.org/w/index.php?curid=62766587>.

the selection of the nuclease used to cut the DNA (eg, Cas9, Cpf1, or engineered high-fidelity versions of Cas9). Off-target effects can be assessed predictively by computer algorithms, which are useful when designing the guide RNA. Computer algorithms are quick, easy, inexpensive, and generally accurate, and thus are very good for basic research

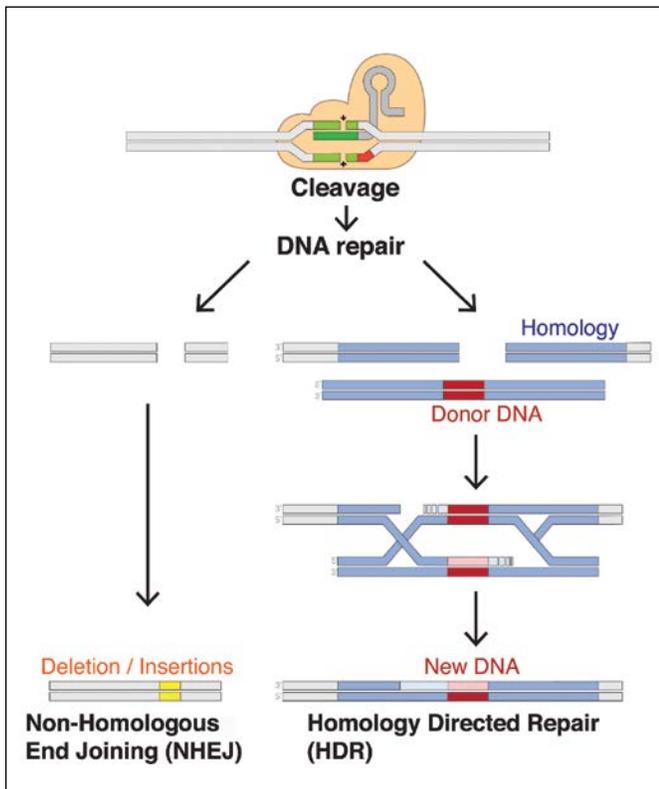


Figure 3. DNA repair via CRISPR. Once the CRISPR/Cas9 gene editing complex has cleaved the target DNA (top), the cleaved DNA can then be repaired via non-homologous end joining (NHEJ) or homology directed repair (HDR). NHEJ is used to revise a single nucleotide or remove a segment of DNA. HDR, which involves providing donor (template) DNA, is used to replace DNA to restore function to the gene. *Image courtesy of Marius Walter via Wikimedia Commons. <https://commons.wikimedia.org/w/index.php?curid=62766588>.*

applications.¹⁵ However, their predictive power is highly dependent on assumptions on how Cas9 and other nucleases operate, and results do not always align because algorithms vary. Health authorities most likely will require more sensitive methods in clinical trials. These more sensitive methods, which include **in vitro** assays and cell-based techniques, are used to detect off-target mutations in an unbiased, genome-wide manner.¹⁵ In vitro assays use software to detect double-stranded breaks in sequencing data of cell-free genomic DNA after the DNA has been cleaved by Cas9 or another nuclease. Although in vitro assays are very sensitive—they can detect off-target mutations that occur at less than 0.1% frequency—they cannot detect mutations that occur inside cells. Cell-based techniques, in contrast, can identify off-target sites in a specific cell type and under particular experimental conditions. Like in vitro assays, cell-based methods are very sensitive and can detect off-target mutations that occur at less than 0.1% frequency.

GLOSSARY

Cleave: cut or splice a molecule by breaking a particular chemical bond.

DNA: deoxyribonucleic acid; a self-replicating material that is present in nearly all living organisms as the main constituent of chromosomes and is the carrier of genetic information.

Germline mutation: any detectable variation within germ (reproductive) cells; mutations in these cells are the only mutations that can be passed on to offspring.

Homologous: having the same structural features and pattern of genes.

In vivo: performed or taking place in a living organism.

In vitro: performed or taking place in a test tube, culture dish, or elsewhere outside a living organism.

Nuclease: an enzyme that cleaves (cuts) the chains of nucleotides in nucleic acids into smaller units.

Nucleic acid: a complex organic substance present in living cells, especially DNA or RNA, whose molecules consist of many nucleotides linked in a long chain.

Nucleotide: a compound consisting of a nucleoside (eg, adenine [A] or cytosine [C]) linked to a phosphate group. Nucleotides form the basic structural unit of nucleic acids such as DNA.

Off-target effects: nonspecific and unintended genetic modifications that can arise during gene editing.

Palindromic: a DNA and/or RNA sequence that is the same when read in either direction (eg, CATGTAC).

RNA: ribonucleic acid; a nucleic acid present in all living cells; its principal role is to act as a messenger carrying instructions from DNA for controlling the synthesis of proteins, although in some viruses RNA rather than DNA stores the genetic information.

Somatic: any cell of a living organism other than the reproductive cells.

Triploid: containing 3 homologous sets of chromosomes. Humans are diploid (having 2 homologous sets of chromosomes).

Vector: something such as a bacteriophage or plasmid that transfers genetic material into a cell.

ETHICAL CONCERNS RELATED TO GENE EDITING AND CRISPR BABIES

Gene editing research has mostly focused on mutations that occur in an individual's somatic cells. Gene editing **germline mutations**, which would affect not only the

individual but also that individual's progeny, have generally been considered completely unacceptable. However, in 2015, Chinese researchers announced that they had performed gene editing on human zygotes.¹⁶ Although the zygotes were **triploid** and thus were never going to be viable, the research community felt that an ethical line had been crossed. In response, the first International Summit on Human Genome Editing was held later that year to discuss concerns over germline editing. Consensus reached at the summit determined that gene editing should not be used to modify human embryos that are intended for use in establishing a pregnancy and that many technical and ethical issues should be settled before anyone attempts germline editing.

The long-term hope is that gene editing tools could be used to fix genetic mutations that cause diseases before they are passed on.

In addition, several countries have issued their own guidelines regarding germline gene editing. In the European Union, germline gene editing is not permitted, although some countries in the European Union permit editing of embryos for basic research with strict regulations: the embryos cannot be implanted or allowed to develop into a human being. In the United States, the National Academies of Sciences, Engineering, and Medicine issued a report concluding that germline gene editing might be permitted in the future, but only with strict oversight.¹⁷ Currently, the National Institutes of Health's Recombinant DNA Advisory Committee will not review proposals on germline editing. Japan issued draft guidelines in September 2018.¹⁸ These guidelines allow the use of gene editing tools in human embryos for research into early human development and restrict the manipulation of human embryos for reproduction, although this would not be legally binding. The long-term hope is that gene editing tools could be used to fix genetic mutations that cause diseases before they are passed on.

In November 2018, at the second International Summit on Human Genome Editing, a Chinese researcher at the Southern University of Science and Technology (Shenzhen, China) reported that he had created the world's first gene-edited babies, twin girls.⁹ The researcher, He Jiankui, also posted a video announcement on YouTube.¹⁹ The news was met with strong condemnation from scientists at the summit and elsewhere. Critics noted that at least 1 of the babies was a mosaic of cells

that had been edited in different ways. Furthermore, He's choice of gene to edit, *CCR5*, was problematic. Editing *CCR5* disabled the CCR5 protein, thereby protecting against human immunodeficiency virus infection. Critics argued that He's choice of gene to edit did not address an unmet medical need—the usual standard for gene editing—and noted that the human immunodeficiency virus infection is preventable and manageable by other, less expensive methods. Finally, He's method for obtaining informed consent is under scrutiny. Instead of using a trained, uninformed professional to obtain informed consent, He did it himself. Compounding the problem, He told potential patients that the experiment was for an AIDS vaccine and did not mention gene editing. To date, He's results have not been published in a peer-reviewed, academic journal.

CURRENT STATE OF RESEARCH

CRISPR babies notwithstanding, clinical research on gene editing-based therapies is underway. No therapies based on gene editing have been approved, but as of December 13, 2018, 20 interventional trials involving CRISPR were registered in the US National Library of Medicine's ClinicalTrials.gov database. The majority of trials are cancer trials, but a few are studies of monogenic disorders such as thalassemia and sickle cell disease.

Animal studies demonstrate the potential of CRISPR-based therapies for a variety of diseases. For example, the use of CRISPR technologies has been reported in animal models of diseases such as heart disease,²⁰ Duchenne muscular dystrophy,²¹ phenylketonuria,²² and hereditary tyrosinemia type 1.²² Another publication reported the use of CRISPR to engineer cancer cells to secrete a protein that triggers a death switch in other cancer cells, resulting in reduced size of tumors and prolonged survival.²³ CRISPR has even been used to engineer a skin patch that secretes an enzyme that digests cocaine.²⁴ Although it is unclear if the findings have implications for the treatment of people with substance abuse disorders, it is an interesting approach.

In addition, companies are developing CRISPR-based platforms for gene editing-based therapies. Pipeline products—still in the preclinical phase—include therapies for diseases such as transthyretin amyloidosis, alpha-1 antitrypsin deficiency, primary hyperoxaluria type 1, sickle cell disease, beta thalassemia, Duchenne muscular dystrophy, cystic fibrosis, and acute myeloid leukemia.^{25,26} It will be interesting to see which programs make it to clinical trials.

CONCLUSIONS

Both gene therapy, which augments a defective gene but does not remove or modify the defective DNA, and gene editing, which corrects the defective DNA in its native location, are promising therapeutic approaches, although the therapies

likely will be expensive. To date, a small number of gene therapies have been approved. The first gene therapy was approved in 2004 in China. Three gene therapies, including 2 chimeric antigen receptor T-cell therapies, have been approved in the United States. As yet, no gene editing–based therapies have been approved anywhere in the world. However, a wide range of CRISPR-based health research is in progress, including clinical trials, animal studies, and the development of CRISPR-based platforms. Although CRISPR is an efficient and versatile tool for gene editing, off-target effects need to be minimized before CRISPR-based therapies can be made available to patients. In addition, reports that 2 CRISPR-edited babies have been born highlight the urgent need to address the ethical concerns of germline gene editing.

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Ancestry DNA Testing and Privacy

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The ancestry DNA testing market is booming. According to industry estimates, the number of people who had their DNA sequenced for ancestry analysis more than doubled during 2017 and now exceeds 12 million.¹ This rapid expansion has prompted many questions about the accuracy of these tests and their impact on consumers' privacy. Can DNA testing really pinpoint where someone's ancestors lived? Why do ancestry DNA results provided for the same individual vary between different companies? What happens to the genetic information and DNA samples after ancestry analysis is completed?

To address these questions and more, Dr Sheldon Krimsky, Professor of Urban and Environmental Policy and Planning at Tufts University, gave a presentation on "Ancestry DNA Testing and Privacy" to AMWA members and guests at the New England Chapter meeting on September 24, 2018. Dr Krimsky has published more than 200 essays and reviews on social and ethical aspects of science and technology. He is the author of 14 books, including *Genetic Justice: DNA Data Banks, Criminal Investigations, and Civil Liberties*. He also serves on the Board of Directors for the Council for Responsible Genetics and as a Fellow of the Hastings Center on Bioethics.²

Ancestry DNA Testing

As of October 2018, the International Society of Genetic Genealogy has listed 35 companies that provide ancestry DNA testing directly to consumers.³ Ancestry DNA testing relies on small variations within the human genome. Although 99.5% of the genome is identical from person to person, variations in single nucleotides—called single nucleotide polymorphisms (SNPs)—contribute to the remaining 0.5%. There are an estimated 10 million SNPs in the human genome, appearing in about 1 in every 300 nucleotides.⁴ A subset of SNPs, known as ancestry-informative markers,

have been detected at dramatically different frequencies among different geographic populations.⁵

Genetic testing companies are using this knowledge to develop proprietary databases of reference DNA samples obtained from people living in different geographic regions. By comparing a genetic sample provided by a consumer to those in their reference sample database, these companies determine what proportion of the consumer's ancestry-informative marker variations match those that are frequently found in a given geographic region. For example, if 60% of the consumer's DNA has variations that are found most frequently in Germany, there is a good chance that those regions of their DNA came from ancestors who lived in Germany. A given variation may frequently occur in one region; however, this does not mean that it never occurs in any other region. For example, a variation that is frequently found in reference samples from Germany could also be present in samples from Japan or Italy.

According to Dr Krimsky, tracing one's ancestry with genetic genealogy tests is largely done as a recreational activity, and there is a common misconception in the general public that ancestry information from genetic genealogy tests can be informative about one's race. He explained that social scientists consider race to be a self-identified variable that is influenced by physical traits such as skin color, eye color, and body form.⁶ Ancestry DNA testing can help consumers find out where in today's world other people share some of their DNA; however, this type of testing cannot determine where all of their ancestors lived in the past, what race or social groups those ancestors identified with, or how consumers should identify themselves today.

Dr Krimsky pointed out that consumers are often not aware of the science- and privacy-related issues that come into play once they voluntarily provide their unique genetic material and personal health information to for-profit

companies for genetic genealogy tests. Even if someone never takes such a test, his or her life might be impacted if a relative or a family member decides to do so.

Science-Related Issues

The results of ancestry DNA testing are heavily influenced by the quality and size of the reference database that is used for comparison. Due to limitations in technology and sample availability, it is not possible to sequence the DNA of our true ancestors who lived hundreds or thousands of years ago. To address this issue, genetic testing companies try to select reference samples from individuals whose families have lived in the region for several generations. However, other than statements that ancestry is validated through family documentation and that reference samples must be unrelated (to avoid bias), little is known about the requirements for inclusion or exclusion of reference samples in the databases.^{7,8}

Ancestry DNA testing results may also be influenced by the number of samples that are included from a given region. Although some genetic testing companies disclose the number and distribution of reference samples in their databases, it is apparent that all geographic regions are not equally represented. For example, the current reference panel used by AncestryDNA® (Ancestry.com LLC, Lehi, Utah) contains more than 16,000 reference samples, many of which were obtained from Europe, including 2,072 samples from Germanic Europe, 1,959 from Eastern Europe and Russia, and 1,519 from England, Wales, and Northwestern Europe.⁹ By comparison, other regions are not well represented, with only 41 samples from Northern Africa, 31 from Senegal, and 30 from Sardinia.⁹ Moreover, as Dr Krimsky discussed, relatively little is known about how the reference samples were obtained—were they random samples or opportunity samples collected as a part of another study? Anything other than a random sampling of the population could introduce bias.

According to Dr Krimsky, ancestry predictions require complex algorithms and statistical analyses. Differences in analytical methods performed using the same reference database would likely result in different ancestry predictions. It is even possible that different results could be obtained from the same genetic testing company as databases and algorithms are updated over time.

At present, ancestry DNA testing has little oversight by scientific associations and is not regulated by the US Food and Drug Administration. In contrast, the Food and Drug Administration does regulate the marketing of direct-to-consumer tests for genetic predisposition to certain medical diseases or conditions.¹⁰ Although ancestry DNA tests do not make health-related claims, the SNPs they employ may be located within the coding or noncoding regions of genes, and

many studies have linked polymorphisms with susceptibility to disease, severity of illness, and response to drug treatment.¹¹ Certain SNPs may not be associated with a disease now, but new research may uncover a link in the future.

Privacy-Related Issues

Since the introduction of direct-to-consumer genetic tests, many privacy concerns and potential risks to consumers have been raised. Nonetheless, laws and regulations have not caught up with industry yet. According to Dr Krimsky, current laws are not broad enough to protect consumers' privacy. The Health Insurance Portability and Accountability Act protects privacy if DNA samples are collected by health care providers (such as a doctor or a hospital), but it does not apply when DNA samples are sent to private companies by consumers. The 2008 Genetic Information Nondiscrimination Act makes it illegal to use genetic information to discriminate against employees or applicants for *health care* insurance, but it does not protect consumers against discrimination in the context of *life* insurance or *long-term care* insurance.^{12,13}

It may not be clear to consumers that the contracts they sign to have their DNA sequenced for ancestry testing often include clauses that give away their rights to profits from any future products developed by using their genetic information.

The ancestry DNA testing industry stores a unique set of data about its consumers. Even though companies may take extensive precautions to protect consumers' data, the risk of hacking and database breaches always exists.¹² In the absence of oversight, it often falls to consumers to learn about and judge the reliability of the company's internal policies for data safety and disclosure of hacking.¹⁴ Consumers may not be aware that companies usually include a warranty clause waiving them from liability in the case of information theft.¹³

Millions of consumers have paid companies to have their DNA sequenced. The resulting large-scale genetic databases can be leveraged to discover mutations that cause diseases or confer response or resistance to certain drugs. As genetic data are usually collected along with individual health information, genetic databases may be used to calculate mutation rates in certain demographic or age groups. For these reasons, many

ancestry DNA testing companies sell their consumers' data to pharmaceutical companies for research and product development purposes.¹² For example, 23andMe (Mountain View, California) provides consumers with the choice of opting into research conducted by academic, nonprofit, and industry organizations.¹² Pharmaceutical companies that have used such data include Genentech for Parkinson disease research¹⁵ and Pfizer for lupus and inflammatory bowel disease research.¹² It may not be clear to consumers that the contracts they sign to have their DNA sequenced for ancestry testing often include clauses that give away their rights to profits from any future products developed by using their genetic information.^{12,13} Further, companies also often retain the right to change their terms and conditions as they find appropriate and without consumers' consent or notification.¹³ Finally, if a company goes bankrupt, is sold, or merges with another company, its privacy policies may no longer be valid or legally binding.¹²

Most ancestry DNA testing companies emphasize that they anonymize their databases and share them with third parties only if the individual consumer opts in. Companies often let consumers opt out of data sharing and research whenever they want and allow them to ask for their entire data set to be permanently deleted at any time. Dr Krinsky pointed out, however, that anonymizing individual genetic data is a very challenging task. A highly skilled researcher with some knowledge about the family tree may theoretically be able to deanonymize the data.¹³ Moreover, if consumers opt out of data sharing and research long after their data had been sold to third parties, it could be very difficult to ensure that all shared data are destroyed.¹²

Recently, ancestry DNA testing companies have started to offer their customers the capability to search for lost or unknown family relatives. There is even a free, online, open-source amateur genealogy database (GEDmatch) that allows users to upload their unique DNA sequences and family trees to have them compared with other users' data on the site.¹⁶ These services may help locate estranged relatives who desire such a union; however, they may also uncover cases of infidelity as well as unknown or unwanted children, which may result in long-lasting family conflicts. Only a few companies warn their customers that their families may or may not want to know the information derived from the ancestry DNA testing and that their relationships with others may be harmed once the information is shared publicly.¹³

DNA sequencing data collected for ancestry analysis may also be requested by law enforcement agencies. Unless there is a court order, it is up to each company to decide whether it wishes to cooperate with law enforcement. Several of the leading ancestry DNA testing companies (eg, 23andMe) explicitly state that they resist law enforcement requests for individual

personal information as much as possible.¹⁷ In any case, it is unlikely that consumers will ever be asked to provide consent for access to their genetic information.¹³

Law enforcement officials, however, do not need a court order to access the publicly available GEDmatch database. Most recently, local police officers in Sacramento, California, used this database to identify the Golden State Killer, a criminal who terrorized California with a string of horrific rapes and homicides in the 1970s and 1980s.¹⁸ In this case, police had DNA evidence from the crime scenes, but investigators were unable to find a match until data from GEDmatch helped narrow down the possible suspects to a single family. As Dr Krinsky explained, officers then watched the house of a member of that family and collected a piece of his abandoned trash for DNA analysis. A match with the killer's DNA finally unlocked the identity of the elusive and unlikely suspect—a retired law enforcement officer.

Conclusions

Based on the popularity of ancestry DNA tests as holiday gifts last year,¹ it appears that many consider these tests to be a fun and harmless activity. However, the genetic information obtained from these tests is associated with serious medical and ethical issues that consumers may not be aware of. Better communication about the scientific accuracy and privacy implications of ancestry DNA testing is clearly needed.

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Introduction from Members Matters Section Editor: Melory Johnson

As one of the Local Networking Coordinators (LNCs) for my chapter, I have attended more than 20 networking events over the past 2 years. At every gathering, I am astounded not only by the eagerness of AMWA members to openly and honestly share their knowledge and experiences but also by the quality of our discussions, so much so that I began to wonder how we could share some of our local exchanges on a national level. As fate would have it, so did Jim Cozzarin, the *AMWA Journal* Editor! He too recognized the value of sharing information from the local level with the AMWA community as a whole—and what better platform than the *AMWA Journal*? So, with that, the Members Matters section was born.



I am very much looking forward to serving as editor of the new Members Matters section and to hearing from both AMWA newcomers and seasoned members about the journal-worthy topics shared at your local gatherings and events. If you have discussed a topic locally that you would like to share on a national level, please email me at melory.johnson@mjmedcom.com.

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So, You Think You Know About Medical Devices?

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Abstract

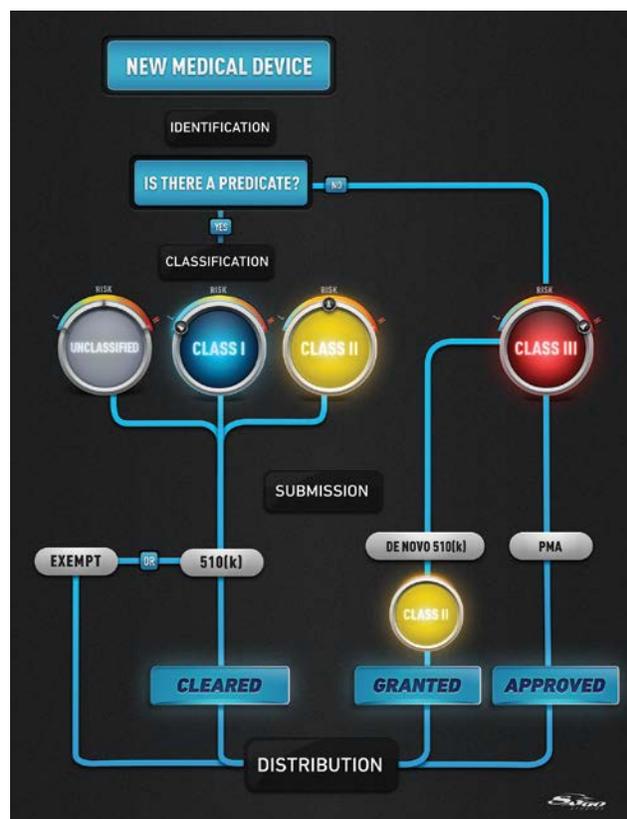


Figure. Schematic representation of medical device premarket review mechanisms.

Introduction

Medical devices encompass nearly every medical product that does not achieve its intended purpose through chemical action or by being metabolized by the body.^{1,2} They range from the simple (tongue depressors and bedpans) to the complex (magnetic resonance imaging machines and laser surgical devices) and from the safe (stethoscopes and ther-

mometers) to the risky (automated implantable cardioverter defibrillators and intra-aortic balloon pumps³). Medical devices include in vitro diagnostic products such as general-purpose lab equipment and test kits (including monoclonal antibody technology); electronic radiation-emitting products such as diagnostic ultrasound and medical lasers; as well as drug-device combinations like drug-eluting coronary stents.^{2,4} What's more, the US Food and Drug Administration (FDA) regulates specific mobile applications, software programs, and smartphone accessories, known as "software as medical devices" (SaMDs).⁵

Medical Devices: What They Are and What They Are Not

The FDA provides a clear distinction between medical devices and other regulated products such as drugs by explaining that if the primary intended use of the product is achieved through chemical action or by being metabolized by the body, the product is usually a drug. However, if a product is labeled, promoted, or used in a manner that meets the definition in section 201(h) of the Federal Food, Drug, and Cosmetic Act (FDCA), it will be regulated as a medical device.²

The 201(h) FDCA defines a medical device as "an instrument, apparatus, implement, machine, contrivance, implant, in vitro reagent, or other similar or related article, including a component, part, or accessory, which is

1. recognized in the official National Formulary, or the United States Pharmacopoeia, or any supplement to them,
2. intended for use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of disease, in man or other animals, or
3. intended to affect the structure or any function of the body of man or other animals, and which does not achieve

its primary intended purposes through chemical action within or on the body of man or other animals and which is not dependent upon being metabolized for the achievement of its primary intended purposes.”

The word *intended* is repeated often in the definition, emphasizing that intentions cannot be underestimated when trying to navigate the labyrinthine complexity of medical devices.

Could a Ballpoint Pen Ever Be a Medical Device?

For dramatic effect, consider the following question: Could a ballpoint pen be intended to treat or prevent a disease or affect the structure or function of the body? Although it certainly does not achieve its primary intended purpose through chemical action within or on the body and is not dependent upon being metabolized to produce that outcome, could it nevertheless under any circumstances be a medical device?

The answer depends on the word *intend*. If claims (either implicit or explicit) are made that label or promote a product in any manner that meets the FDCA definition for a medical device, that product will be regulated as a medical device. Unlike drugs, medical device classifications rely almost exclusively on claims (labeling) for their intended use. So, if the implicit intention of the pen manufacturer or supplier is to use that pen as a surgical tool for leaving a mark—after all, the explicit definition of a pen is that of “an implement for writing or drawing with ink as a means of expression”⁶—the pen, in fact, *does* meet the definition for a medical device and thus *will* be subject to pre- and postmarketing FDA regulatory controls. In the end, it all comes down to *intended* use.

Medical Device Classification

For much of the 20th century, medical devices were largely unregulated and subsequently were not subject to regulatory review.³ To address this gap and prevent the distribution of dangerous and ineffective devices, in 1976, Congress passed the Medical Device Amendments to the FDCA,⁷ creating a comprehensive premarket review mechanism. Thus, a 3-tiered scheme was developed that stratified devices into distinct “classes,” corresponding to their potential risks.

Determining Classification

To determine the class of a medical device, the FDA takes into consideration its intended use, labeling, indications, and associated risks. Just as the risks differ with each device class, so do the regulatory control requirements. The greater the risk, the higher the classification and the more stringent the regulatory controls. Devices that were marketed legally in the United States before the Medical Device Amendments are referred to

as *preamendments devices*; those that entered the US market afterward are called *postamendments devices*.

Class I devices are the least risky of all medical device products and include surgical masks and dental floss. They are not intended to support life or prevent health decline and do not pose unreasonable risks for injury or illness. To ensure the safety and effectiveness of Class I devices, the FDA employs *general regulatory controls* that include (a) registration—of both product and manufacturer, (b) regulation—to ensure that good manufacturing practice standards are upheld, and (c) labeling—according to strict guidelines.

Class II devices are riskier and more complex than Class I devices, and general controls are usually not sufficient to ensure their safety and effectiveness.⁸ Therefore, Class II devices are also subject to *special regulatory controls*, which may include particular labeling requirements, patient registries, postmarket surveillance, and FDA-recognized performance standards. Devices in this category include wheelchairs and infusion pumps. The majority of all medical devices fall in Class II.⁹

Class III devices make up the smallest proportion of medical devices on the market.⁹ These devices pose an unreasonable risk for illness or injury and are intended to sustain and improve life or prevent impairment of human health. Examples of Class III devices are HIV diagnostic tests and heart valves. Class III devices are subject to both general *and* special controls.

An *unclassified* device is a preamendments device for which a classification regulation has not been promulgated.¹⁰ A *not-classified* device is a postamendments device for which the FDA has not yet reviewed a marketing application or made a final decision on the application.¹⁰

Reclassification

The process of reclassifying a medical device may be initiated by the FDA or in response to a petition from an outside party. Both pre- and postamendments devices can be reclassified as long as the FDA or petitioner (a) provides sufficient evidence to prove that the device meets the appropriate classification definition, (b) presents new publicly available information on the device type, and (c) identifies sufficient valid scientific evidence to support a determination that the safety and effectiveness of that device type can be assured through the relevant regulatory controls of the new class.

The orders must highlight the public health benefits of reclassification, the risks associated with the device type, and the frequency at which the risks occur. When reclassifying a preamendments device from Class III to II, the order must provide evidence that the general controls are sufficient to ensure safety and effectiveness. If approved, an FDA-published order

will describe the reasons for the approval as well as the health risks posed by the device.

Medical Device Premarket Submission

Premarket Approvals and 510(k)s and Exemptions, Oh My!

Once a device is classified, its manufacturer must submit a premarket submission to the FDA. There are 2 types: the *premarket notification* (510(k)) and the *premarket approval* (PMA).

The purpose of a 510(k) is to notify the FDA of a manufacturer's intention to market a device and demonstrate its substantial equivalence (SE) to a previously marketed or *predicate* device. In most cases, 510(k)s—named for the relevant section of the FDCA—do not require clinical data. Some Class I, most Class II, and certain unclassified medical devices require 510(k)s.

Because of the nature of their classification, Class III devices are subject to a premarket review procedure that is different from those of Class I or II devices. The PMA is analogous to the new drug application. The sponsor must submit to the FDA valid scientific evidence, based on clinical trials, that directly establishes device safety and efficacy. As a part of the PMA, the applicant must provide evidence that the benefits of the device outweigh its potential risks and that a large portion of the population will benefit from it. Without PMA approval, a Class III device cannot be legally marketed in the United States.

Under certain circumstances, a device also may be considered *exempt*.⁹ This includes the majority of Class I and certain Class II devices, as well as preamendment devices that have not been changed substantially and have no published requirements for additional regulatory control.¹¹ Exemptions help free up FDA resources so more time can be spent focusing on those submissions that will have a significant benefit to public health.¹¹ Devices that qualify for 510(k) exemption may immediately go to market but must meet general regulatory controls.

A *humanitarian-use device* is a device intended to treat and/or diagnose rare diseases or conditions. The *humanitarian device exemption* (HDE) application is similar to that of a PMA. Scientific evidence must be provided to show that the benefits of the device outweigh its risks and that the device will not expose patients to an unreasonable risk of injury or illness.¹² Unlike PMAs, however, HDE applications do not have to prove device efficacy. In support of either a PMA or an HDE application, a device may receive an *investigational device exemption* that allows for its use in clinical studies.¹³

A Note about Substantial Equivalence

Usually, predicate devices are 510(k) cleared; however, any legally marketed device can be used to demonstrate SE,

as long as it can be established that the device and its predicate have

- the same intended use *and*
 - the same technological characteristics
- or*
- the same intended use *and*
 - different technological characteristics, which do not raise other questions of safety and effectiveness, *and*
 - information submitted to the FDA demonstrating that the device is at least as safe and effective as the legally marketed device.¹⁴

Devices that are the SE to a previously classified device fall into the same classification as their predicates.

De Novo Classifications

New types of medical devices that have no predicates are automatically classified as Class III. However, manufacturers may submit a request for *de novo* classification should they wish to reclassify these products as a lower class. *De novo* classifications may also be used if a product (a) has undergone a 510(k) review without demonstrating SE because no predicate exists, (b) has a *new* intended use, or (c) has different technological characteristics from the predicate and raises questions about safety and efficacy. To be eligible for *de novo* classification, the general and special controls must be sufficient to ensure safety and efficacy. Moreover, there must be a clear understanding of the risks of the device and distinct ways of mitigating them.

Device Regulation

One of the responsibilities of the FDA is to protect the public health by ensuring the safety, efficacy, and security of not only drugs and biological products but also medical devices. The agency promotes and regulates the development and production of high-quality products to assure that the devices available in the United States are safe and effective. In support of that goal, the agency created a compliance program that encompasses 5 regulations for inspecting device firms:

1. The Quality System regulation (21 CFR Part 820)¹⁵
2. The Medical Device Reporting (MDR) regulation (21 CFR Part 803)¹⁶
3. The Medical Device Tracking regulation (21 CFR Part 821)¹⁷
4. The Corrections and Removals regulation (21 CFR Part 806)¹⁸
5. The Registration and Listing regulation (21 CFR Part 807)¹⁹

Under the Quality System regulation, manufacturers are expected to control their devices from design through post-market surveillance. The MDR, Tracking, and Corrections and Removals regulations involve device postdistribution activities with which both manufacturers and importers are required to

comply. The Registration and Listing regulation requires manufacturers to register and list their products and requires importers to register.²⁰

Compliance Issues

When medical device products and their manufacturers, suppliers, importers, or exporters do not comply with regulations, the FDA takes action to enforce the law.⁵ Besides the usual fines, custodial sentences, inventory seizures, quarantines, recalls, consent decrees, padlocking of the premises, arrests, and so forth, the FDA can request an audit at any time and without announcement. These penalties should be a reasonable expectation, particularly if a company manufactures Class II or III devices, and companies can expect to see agents every 2 years or more.

In some cases, the FDA may issue a *Warning Letter*, which can often take upwards of 6 months to resolve. A Warning Letter could not only cost the firm dearly in consulting fees and other big-ticket expenses, but because these letters are found on the public domain, they can result in reputational damage as well.

Any concerns or objectionable conditions discovered during an inspection are documented and communicated with the *FDA Form 483*.²¹ Every year, the FDA issues thousands of 483 notifications to medical device and other companies²² (Table 1). Last year, device-related citations accounted for about 20% of all issued 483 notifications²³ (Table 2). Here are 4 of the most common:

1. Corrective and preventive action (CAPA)²⁴—when CAPA procedures have not been adequately established or documented, a notice of violation is issued.
2. Complaint handling procedures²⁵—while still in the process of designing and building a device, a company may not be concerned with this violation; however, they will be once the device is in the marketplace.
3. MDR procedures¹⁶—or the lack thereof. Some prevalent deficiencies include (a) no recorded protocols or plan in place to implement a written procedure that would satisfy the regulatory requirements; (b) omitting essential terms, such as *caused or contributed, became aware of, malfunction, MDR reportable event, or reasonably suggests*; and (c) omitting key descriptions (eg, when a particular procedure will be implemented).
4. Nonconforming product procedures²⁶—a chief concern for certain device manufacturers is that systems for the control of nonconforming products are not adequately in place. Nonconforming products should be identified and separated.

Quality and Compliance

Relying on enforcement action alone does not translate to

Table 1. FDA 483 Notifications for Fiscal Year 2017

Center Name	483s Issued N (%)
Biologics	115 (2.3)
Bioresearch Monitoring	243 (4.8)
Medical Devices	1,030 (20.4)
Drugs	694 (13.7)
Foods	2,662 (52.8)
Veterinary Medicine	244 (4.8)
Other ^a	167 (3.3)
Sum Product Area 483s from FDA System ^b	5,155
Actual Total in System 483s ^c	5,045

This table does not represent the complete set of 483s issued during the 2017 fiscal year, as some were manually prepared and not available in this format. FDA, US Food and Drug Administration.

^aIncludes radiological health and human tissue for transplantation.

^bThe sum of 483s for all product areas will be greater than the actual total 483s issued during the fiscal year because a 483 may include citations related to multiple product areas, and each citation may be counted more than once, appearing under each relevant product center.

^cThis is the actual total number of 483s that were issued from the FDA Inspectional Observations System and that are represented in this spreadsheet.

Table 2. Top Reasons for 483 Notifications for Medical Devices in 2017

Short Description	Total 1,030 N (%)
CAPA Procedures	400 (38.8)
Complaint Handling Procedures	269 (26.1)
Purchasing Controls ^a	138 (13.4)
MDR Procedures	127 (12.3)
Nonconforming Product Procedures	127 (12.3)
Documentation	115 (11.2)
Design Changes	80 (7.8)
Quality Audits	78 (7.6)
Final Acceptance Procedures	67 (6.5)
DMR	64 (6.2)
Document Control Procedures	61 (5.9)

CAPA, corrective and preventive action; DMR, device master record; MDR, medical device reporting.

^aPurchasing controls are a serious issue for medical device companies. We will focus more on this and other related issues, including the importance of the right supplier, in the articles that follow.

high-quality medical devices on the US market. So, to promote and encourage quality design and manufacturing practices and to provide options on demonstrating compliance, the FDA implemented these programs²⁵:

1. The Case for Quality Program²⁷
2. The Medical Device Single Audit Program (MDSAP)²⁸

Through these initiatives, the FDA works with industry and other stakeholders to shift the focus from regulation only to collaboration and partnership. The Case for Quality initiative, in particular, focuses on quality rather than on compliance-based “check-box” activities. The vision of the Center for Devices and Radiological Health (CDRH) is the driving force behind this patient-centric shift: work together to drive the best possible public health outcomes through collaboration and stakeholder engagement.

The MDSAP is a huge advantage for companies trying to enter multiple markets simultaneously. Through an *ISO 13485:2003* framework and good manufacturing practice requirements from the various regulatory authorities, a standardized global approach to the auditing and monitoring of medical device manufacturing was developed. The fundamental goal of the MDSAP was to create an international coalition to improve medical device safety and oversight on a global scale and create a single-audit program that provides confidence to foreign regulators. (Consider the effect this could have on Brexit!)

In short, the CDRH initiatives help identify barriers to medical device quality and develop innovative ways to remove these barriers, affording patients access to high-quality devices. Even though the programs are of great significance to the medical device industry, in support of the elementary nature of this article, these programs will be covered in more detail in a separate article.

Beyond Manufacturing

After premarket clearance/approval, the FDA requires the registration of both the device and establishment as well as the listing of all devices manufactured at the facility. Establishment registration and medical device listing provide the FDA with ways to track medical devices and allow for an expeditious response should a public health emergency arise.

It's All about the Labeling

Medical device labeling is intended to assist end users with device recognition, storage, assembly, operation, and troubleshooting. Labeling that cannot be understood or does not communicate critical information about the device is ineffective.²⁹

Through the CDRH, the FDA assures that patients and providers have timely and continued access to safe, effective, and high-quality medical devices and safe radiation-emitting prod-

ucts. The CDRH provides consumers, patients, caregivers, and providers with understandable, accessible, and current science-based information about the products it oversees.³⁰

One part of protecting the public health is to ensure that medical devices are adequately labeled, so that the labeling can be effectively used by the device operator and complement device training. Thus, the term *medical device labeling* is all-inclusive, referring not only to the direct product label but also to any accompanying materials contained in the packaging (including user manuals). Consequently, the term is of enormous interest to device premarket submission preparers.

Although this defines what labeling is and where it should be placed, it does not explain what information should be included on the label or what is considered *mislabeled*. Regulatory labeling requirements (including language and symbols), as well as MDR and other FDA issues, will be covered in detail in subsequent articles. Additionally, the articles will delve into the complexities of the medical device FDA premarket submission process, including design controls, nonclinical testing, and clinical evidence.

Conclusion

The purpose of this article was to present a preliminary understanding of medical devices: what they are, what they are not, and how they are classified and regulated, including quality, compliance, and preparing for submission. The subsequent articles will cover in more detail the FDA submission process; regulation and compliance, including cautionary tales; medical device “oddities,” like SaMDs; and some of the issues associated with the premarket review process. Even though this article presents an elementary perspective of the field, the series as a whole aims to provide a grand overview of the field to assist medical communicators in navigating the complexities of pre- and postmarket FDA-approved medical device communications.

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Commentary *continued from page 55*

AMWA's mission is to "promote excellence in medical communication and to provide educational resources in support of that goal." We have been faithful to that mission and have earned success in addressing the fundamental skills in medical communication with our Essential Skills certificate. We need to ensure that our education also targets higher-order skills and knowledge, not only in writing but also in literature search strategies, appraisal of the literature, critical thinking, and other important areas as defined by research.

It is imperative that medical communicators in all settings possess knowledge and skills of the highest caliber. As our profession continues to grapple with the best way to define our identity and demonstrate the value of our contributions, we must consistently produce high-quality documents. We also must continue to conduct research that helps define educational gaps.

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Social Media and the DNA of Health Care

Lee Aase / Director, Mayo Clinic Social Media Network, Mayo Clinic, Rochester, MN

Mayo Clinic celebrated the [10-year anniversary](#) of its Facebook page on November 7, 2017, having created its page on the first day Facebook made this type of presence available to organizations.

Why was Mayo such an early adopter when few other hospitals were even considering social media?

Health care is by nature a risk-averse industry. One might even say this aversion is a protective feature of its DNA; in the clinical setting, we expect our providers to prescribe therapies and medications and perform operations and interventions that have been scientifically validated. When they want to experiment with approaches they think may be improvements, rigorous procedures protect human subjects from harm and also secure informed consent for possible deviations from standard of care.

In tandem with this process for developing validated treatments, a global system for disseminating knowledge and best practices has developed, with both formal and informal mechanisms. Scientific peer-reviewed journals represent the former end of the spectrum, whereas medical society gatherings, visiting lecturers, and faculty exchanges exemplify the latter. And because of their unique placement in space and time, Mayo Clinic's founders both participated in and helped to shape this "social networking" among physicians.

William J. Mayo, MD, and Charles H. Mayo, MD, were the sons of a frontier physician, Dr William Worrall Mayo, who arrived in Rochester, Minnesota, in 1864. They assisted him in his practice even as young boys and also shared his interest in surgery. They came of age just as improved anesthesia and aseptic methods made more complex operations feasible while reducing postsurgical mortality. This led to global experimentation and rapid improvement in techniques.

The Mayo brothers realized that to provide the best care to their patients, they needed to learn from their peers, and the advent of train travel made that possible. Dr Will would

typically visit and observe other surgeons for several weeks each spring, whereas Dr Charlie stayed behind to care for patients; in the fall, the roles reversed. By the late 1920s, Dr Will had studied surgery in every city with a population of 100,000 or more in the United States and Canada and had crossed the Atlantic Ocean 30 times. He visited and observed surgeons in 25 countries altogether—ranging from Australia and New Zealand to Argentina, Russia, and most of Europe—all before the era of air travel.

The trains ran in both directions, however: between 1908 and 1918, nearly 3,400 physicians traveled to Rochester (population approximately 5,000) to observe and learn from the Mayo brothers, becoming members of an informal society called The Surgeons Club. These professional interactions led to doctors coming to the Mayos for their own ailments. They also referred patients who subsequently shared their experiences with family and friends.

This old-fashioned analog social networking, among both professionals and patients, was essential to Mayo Clinic's development and growth. A century after the peak of The Surgeons Club, and with the population of Rochester now just over 100,000, patients come to Mayo Clinic from every US state and more than 140 countries each year.

As I began my career at Mayo Clinic in 2000 as a member of the media relations team, I learned during orientation that the most important sources of information for those choosing Mayo Clinic were word of mouth, news media stories, and physician referrals. Our team's focus was working with journalists and facilitating more of those news media stories, including through syndicated features.

In 2005, after I had become manager of the team, we saw opportunities to experiment with what we then called "New Media." We created an RSS feed for our daily syndicated radio segment and listed it in Apple's month-old iTunes Podcast Directory, and fortunately saw it featured on the front page for 3 weeks. The resulting 8,100% increase in

audio file downloads helped us make the case that we should explore further, leading us to experiment with YouTube, consumer-grade video cameras, Facebook, Twitter, and blogs.

Our initial applications were aimed at doing media relations work more effectively, such as pitching story ideas through YouTube videos of physicians and featuring patients, instead of by press release or phone calls.

We soon saw opportunities to go deeper with narrower audiences of patients interested in highly specialized content about relatively rare diseases and conditions for which Mayo Clinic had leading expertise. Instead of only reaching mass audiences with general interest news via journalists, we also could engage audiences directly and invite them to share their perspectives.

Some hospitals hesitated to use social media because of concerns related to patient privacy and particularly the requirements of the Health Insurance Portability and Accountability Act of 1996 (HIPAA). Mayo Clinic's previous media relations work and proper understanding of the regulatory environment of health care were essential to our ability to venture into these new platforms.

Through an analysis of the issues in collaboration with our Mayo Clinic Legal Department, we determined that those barriers to engagement could be easily addressed. HIPAA prohibits covered entities, including hospitals, from disclosing protected health information about patients without their consent. In our media relations work, we had facilitated patient stories for many years by obtaining exactly that type of patient consent, so in our "new media" world of blogs and social media, we would require the same signed authorization before Mayo would publish any protected health information on our platforms.

But patients aren't covered entities under HIPAA: If they choose to disclose information about themselves on public social media sites, even on a hospital-sponsored page, the hospital isn't publishing the information—the patient is. So the privacy-based obstacles to engagement could be overcome either through a standard media release or through proper understanding of who was actually initiating publication.

As colleagues from other hospitals saw Mayo Clinic's social media initiatives, they inquired as to how Mayo had resolved concerns and asked for resources to help drive their organizations' social media adoption. As we relayed these questions, Mayo Clinic leaders saw an opportunity to create a modern-day analog to The Surgeons Club, but this time for social media.

In July 2010, they established the Mayo Clinic Center for Social Media and the Social Media Health Network, now combined as the Mayo Clinic Social Media Network (#MCSMN), to accelerate adoption of social media strategies throughout the Mayo Clinic enterprise and to serve as a resource for peer organizations.

Whereas Mayo Clinic's social media efforts had been focused on public relations and marketing applications, the goal of #MCSMN was to encourage use of social media to support clinical practice, research, and educational objectives. #MCSMN staff consulted with internal stakeholders to help them conceive appropriate social media strategies and developed resources to support their efforts. They also recruited a diverse group of external thought leaders and practitioners to serve on the #MCSMN External Advisory Board.

In addition to making exemplary guidelines and related documents available to peers globally, beginning in 2011, #MCSMN has accomplished the following:

- Developed Social Media Residency as a day-long immersive course for professionals interested in quickly becoming familiar with these tools and creating strategic social media plans
- Hosted annual conferences at its campuses in Minnesota, Arizona, and Florida to bring together network members to share case studies and best practices
- Held 2 International Healthcare and Social Media Summits in 2015 and 2016 in Brisbane and Melbourne, Australia, in response to an invitation from participants in these conferences
- Collaborated with Hootsuite, Inc, to create the first continuing medical education–accredited online course in the basics of social media for health care professionals in 2015
- Created a sister site, Mayo Clinic Connect, which is a community of communities with more than 80,000 patients and caregivers who support and encourage each other as they share their experiences in more than 50 disease-specific groups

As social media in health care has come of age and become more widely adopted, #MCSMN has evolved to become a free platform for anyone interested in these applications to engage in discussions and to make connections with like-minded peers. Its core premium offering is a corporate membership that offers employees of member organizations unlimited access to the same training resources Mayo provides to its own staff.

In so doing, we're keeping faith with the legacy bequeathed to us by the Mayo brothers. As Dr Will said, "It is a great thing to make scientific discoveries of rare value, but it is even greater to be willing to share these discoveries and to encourage other workers in the same field of scientific research."

In his day, members of The Surgeons Club paid dues of \$1 for their educational visits to Rochester. Thanks to the scalability of digital platforms, today's annual corporate dues for #MCSMN are even lower, especially accounting for inflation... and without the time and expense of travel.

Mayo Clinic's social media leadership through #MCSMN is a natural extension of the social networking that was so instrumental in its founding and early development. Its continued

existence and growing relevance support this thesis: If social media had been seen as a harmful mutation, it would have been rejected by the organization's immune system.

Beyond its consistency with Mayo Clinic's organizational origins, social media used properly is an expression of the DNA and fundamental values of health care more broadly. By enabling connections among those sharing personal or professional concerns about diseases and conditions, social media tools can disseminate the latest knowledge, inspire exploration, and enable community and mutual support.

In political life, much of the promise of social media has gone unrealized, undermined by partisanship. Although pockets of partisanship also exist in health care, such as among vaccine skeptics, opposition to the common enemy of disease and infirmity has enabled greater unity and effectiveness in health-related applications of social media platforms.

As more health care professionals and organizations join online discussions, the pace of change can accelerate. We look forward to supporting their involvement.

Author declaration and disclosures: *The author is Director of the Mayo Clinic Social Media Network but derives no personal compensation from sale of its products and services.*

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State College, Pennsylvania

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AMWA Medical Writing & Communication Conference

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MEDIA REVIEWS

Big Squeeze: A Social and Political History of the Controversial Mammogram

Handel Reynolds, MD

Ithaca, NY: Cornell University Press, 2012, 121 pages, \$19.95 (hardcover)/\$14.95 (paperback)/\$14.20 (Kindle)

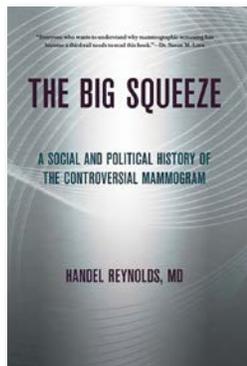
“Mammography can detect cancer as small as the period at the end of this sentence.”

Many people may remember this succinct and compelling phrase that was posted in advertisements on billboards and bus stops in major urban areas during the height of the breast cancer activist movement of the late 1980s to early 1990s. But the public may be less aware of the fact that, since the first inception of screening mammography more than 40 years ago, the question of whether all women under 50 should be screened has been a major point of contention in the medical community.

In his book *The Big Squeeze: A Social and Political History of the Controversial Mammogram*, Dr Handel Reynolds explores the origins of this controversy and how certain key social and political developments would set mammography on a “trajectory that would eventually make it the second most commonly performed cancer screening test” and spawn a multibillion-dollar industry in the process.

Reynolds, who was a practicing radiologist before his death in 2013, begins the book by discussing the first (and, to date, only) randomized, controlled trial in 1963 that demonstrated the benefits of screening mammography for women ages 50 to 59. But when mammography was later introduced to the public at large in the early 1970s (when the fight for women’s civil liberties and reproductive freedoms came to the forefront of public consciousness), women’s groups, medical advocacy organizations, and policymakers framed the issue of mammography access—even for women as young as 35—as a fundamental women’s health issue. Since then, whenever medical experts (such as the United States Preventative Services Task Force panel in 2009) have advised against the practice of screening women under 50, the backlash has been swift and robust.

With yet another US election just on the horizon, during which health care access policies will inevitably be hotly debated, the story of mammography as presented in *The Big Squeeze* is the perfect case study on how strong science can quickly and easily be usurped by political expediency and cultural zeitgeist. The book’s only obvious shortcoming is that it only briefly mentions genetic testing for breast cancer-related mutations; if the book had been written several years later, perhaps Reynolds would have included a passage about the



Angelina Jolie Effect (<https://hms.harvard.edu/news/angelina-jolie-effect>).

The Big Squeeze should certainly be of interest to health care professionals and public policymakers, but because it is also succinct and accessible enough for a layperson audience, women who are on the fence about mammography would benefit from reading it as well.

Reviewer: Stefanie Howard, MA

Stefanie is a freelance medical editor and writer living in Stirling, NJ.

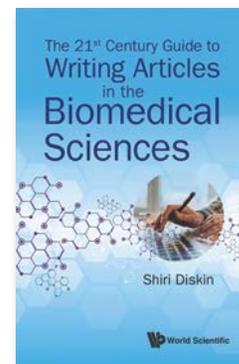
* * *

The 21st Century Guide to Writing Articles in the Biomedical Sciences

Shiri Diskin, PhD

Hackensack, NJ: World Scientific, 2018, Paperback, 132 pages, \$28.00

For many beginning students in the health sciences, there seems to be an unspoken expectation that they undertake research. Although many students find a kind and patient mentor who is able to shepherd them methodically through the research and writing process, gradually giving them more responsibility, the majority inevitably find themselves in a situation in which they haphazardly slap together a small project or find a way to tack themselves onto a paper, all in the hopes of getting published or fulfilling a requirement of their program. Dr Shiri Diskin, a molecular biologist who has worked for more than 15 years in the medical writing profession as a writer, editor, and reviewer of scientific journal articles, books, and regulatory documents, has written a book targeted toward beginning medical writers. More experienced readers of the *AMWA Journal* will find *The 21st Century Guide to Writing Articles in the Biomedical Sciences* useful as an update covering current conventions and online tools useful to many subtypes of medical writing.



The Guide includes 9 chapters, each covering major topics on aspects of preparing, carrying out, and completing a publication based on a research project. The first chapter, “Before You Write,” describes how a would-be researcher needs to set up the right habits, such as reading in the chosen field and understanding basic research ethics, even before putting pen to paper. The second chapter, “Choosing Your Target Journal,” provides useful advice on how authors can select a journal that they feel would best be a home for their work and how to adapt their writing to the journal’s specific rules.

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How to Build a Medical Writer: Medical Writing Apprenticeships—New Training for a New Breed

Julia Forjanic Klapproth, PhD¹ and Lisa Chamberlain James, PhD² / ¹Trilogy Writing & Consulting, Frankfurt am Main, Germany; ²Trilogy Writing & Consulting, Cambridge, United Kingdom

Everyone involved in preparing regulatory documentation in the pharmaceutical industry is always on a desperate look out for excellent medical writers with years of experience writing the documents they need. But those mythical beasts are few and far between. One reason for this is that there is very little training provided across the industry that is actually tailored to produce medical writers—let alone excellent ones.

In fact, although the discipline of medical writing is no longer “new,” the path to becoming a medical writer is still often shrouded in mystery. The training available to those new to the profession varies considerably and very much depends on the institution hiring the new medical writer. Many medical writers learn the job by the “sink or swim” method: they are hired based on signs of potential and a basic skill set, given a set of journal “Instructions to Authors” or the International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH) regulations and some data, and told to “carry on.” Or, they decide to become freelance medical writers—because they have a science degree and they know how Word works, so they just follow the regulations and try to “figure it out.” It is not surprising that so many documents are so poorly written if this is the status quo of becoming a medical writer.

Some companies (in particular pharmaceutical companies) offer some form of internal, on-the-job training, which can vary from providing the trainee with the SOPs and internal company writing guidelines and letting them ask questions, right through to specialized training carried out by both internal and external trainers. However it is done, and to whatever extent, two things are true: there are costs associated with training a new writer in terms of time and budget, and without training, both the writer’s skill set and the quality of their end product will suffer.

In fact, good medical writing is more than just a particular skill set, it is a *craft*, which means that it takes time to learn and hone. For example, medical writers must take materials from various sources, of various quality, and mold all relevant information into a succinct and coherent story. On its own, the ability to communicate any idea (whether scientific or not) clearly is a craft unto itself. However, on top of this, medical writers must have the ability to work with many different contributors and accurately capture what all of those people envision is the right story to tell—often teasing out the key messages from tangential ideas to help keep the story focused and meaningful. The combination of crafting thought into the written form and guiding teams through mountains of data and sometimes heated and politically charged discussions is a dual skill set that must be developed and refined to cultivate medical writers who are masters of their craft. The newly updated “medical writing competency model” outlines beautifully the core skills, knowledge, and abilities required of a medical writer, but does not address the mechanisms to acquire them.^{1,2}

Most companies that recognize the importance of training their medical writers use a mentorship approach, in which less experienced writers have a designated, more experienced writer as a mentor to provide help, support, and guidance. Mentoring is traditionally defined as “a process in which a more skilled or more experienced person, serving as a role model, teaches, sponsors, encourages, counsels and befriends a less skilled or less experienced person for the purpose of promoting the latter’s professional and/or personal development.”³ Combined with other methods of teaching (eg, workshops, conference attendance, training courses), the rewards of this form of teaching can be immense to both the company and the employee, and higher

staff retention rates and job satisfaction scores are seen.⁴ Medical writers are well aware of mentoring—the Australasia Medical Writers Association has a formalized mentoring program for medical writers,⁵ and some universities offer mentoring opportunities to students for medical writing.⁶ The concept is also embraced in the pharmaceutical industry, and “mentoring ability” is often a requirement for more senior-level writers.

However, mentoring usually takes the form of formalized meetings at regular intervals, with the mentor and mentee going about their daily lives with little interaction in the interim.⁷ To truly learn the craft of medical writing, merely providing a mentor to guide and offer advice on occasion is rarely enough. As for any skilled craft, what is needed is a true apprenticeship. The Lombardo and Eichinger 70/20/10 Learning and Development model states that approximately “70% of knowledge or development comes from on-the-job experiences, tasks, and problem solving, 20% from feedback and from working around good or bad examples of the need, and about 10% from courses and reading.”⁸ Medical writing is no different and should be learned on the job and under the tutelage of a master craftsperson—someone who already has the knowledge and skills not only to explain what should be done but also to show the pupil how to do it. This is a true apprenticeship. It incorporates the traditional methods of workshops and training courses, as well as intensive, ongoing, on-site training given on a one-to-one basis.

Apprenticeships require investment from all involved—from the company that must give the time to its employees to work together and from the supervisor and apprentice who must both invest time and energy in a learning experience that can last months or even years. Whilst this approach is well known and finely honed in other industries, the idea of apprenticeships for medical writing is almost unheard of. Many articles have been written extolling the virtues of being able to learn under the guidance of a more experienced writer,^{6,9,10} but true apprenticeships involve a level of on-the-job training and learning that goes far beyond traditional mentoring and are rare.

In the case of medical writing, it isn't necessary for the “master” to be a single person. A medical writing apprenticeship hinges on working closely with master medical writers who are very experienced and skilled in the area that the apprentice is trying to learn, and it moves far beyond traditional mentoring. Working closely with several experienced writers on different projects has the added advantage of sharing a broader knowledge and experience base with the apprentice.

Ideally an apprenticeship will last as long as it takes for a trainee writer to grow into their craft, culminating in their

demonstrable ability to produce and manage complete documents on their own to everyone's satisfaction. This is a process that can take anywhere from 3 to 5 years and varies with each writer. Everything the apprentice writes is reviewed and revised by an experienced writer, who then explains the rationale for the changes made. As the apprentice demonstrates their ability to handle specific pieces of the document, they are given more complex sections to produce, and the process of review and revision continues until the apprentice is fully competent.

Shadowing the experienced writers as they work with authoring teams helps the apprentice learn what types of issues are worth fighting for and which ones can be accepted as is. They learn and understand what decisions they can make on their own and which ones they need to get team input on; what information they should spend time researching and what they should go back to their experts for. It is the balance of “getting on with it” to pull the document together from what is available and knowing when to go back to a team to get further advice or trigger important team discussions that makes a good medical writer an added value to their teams. It is through the knowledge transfer from the experienced writers to the apprentice on a day-to-day basis at all levels of the job that the apprentice learns how to make the many decisions a medical writer is confronted with.

In addition to the day-to-day guidance provided by the “master” medical writer, a true apprenticeship also involves regular course work over the duration of the apprenticeship program to deepen the apprentice's theoretical knowledge and academic understanding of the area in which they are specializing. It is possible to meet this need in the context of medical writing by means of onsite and online training courses available from organizations such as the European Medical Writers Association,¹¹ the American Medical Writers Association,¹² and the Australasian Medical Writers Association,¹³ all of which offer certificates in many areas of medical writing. Other courses of varying length and cost are also available, including Master's Degree courses.¹⁴ Unfortunately, these training options are used by many companies as the sole method of teaching their writers, without the essential day-to-day training that new writers need to then learn how to apply the theoretical tools they have learned. If the industry wants and expects to have medical writers who excel at their craft, then these two parts must go hand in hand.

With increasing legislation, decreasing timelines, and the new technological/artificial intelligence-based advances in medical writing, the demands on medical writers and the requirements of their skill set are increasing exponentially. We truly are demanding a new breed of medical writers, who must not only be expert writers but robust enough to adapt on

an ongoing basis to new regulations, an increasingly stressed pharmaceutical industry, and to having more and more responsibility placed on their time and skills. It is an exciting and thrilling time to be a medical writer—increasing demands bring with them increasing opportunities—but training for this “new world” cannot be done with training courses and mentorships alone.

Good medical writers are born ... but excellent medical writers are created through apprenticeships.

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Writing the Basic-Science Hypothesis: A Practical Guide for Medical Writers

Kerry L. Evans, PhD, ELS / Editor, Science Communication Group, University of Arkansas for Medical Sciences, Little Rock, AR

Why can't anyone write a hypothesis? During my relatively short tenure as a medical writer and editor, I've asked myself this question one too many times. My own background is in the basic sciences, in which research is guided by a hypothesis—a scientific statement that guides experiments and is supported or rejected by the experimental outcomes.¹⁻³ The hypothesis is a key concept in the scientific method,¹⁻³ visualized here as a continuous process (Figure).

Despite the prominent place of the hypothesis in basic-science research, it is my experience that PhD-level investigators often struggle to write one (although their research is inherently hypothesis driven). Several things could explain this—deficits in mentoring and graduate-level education in research methods, as well as lax publishing standards, for starters. Although medical writers and editors can't fix these issues at the root, we can help investigators communicate their hypotheses clearly and concisely.

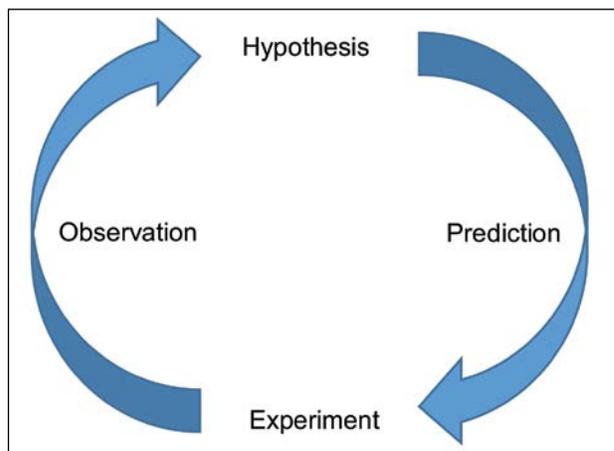


Figure. The scientific method is a continuous process. A hypothesis informs predictions, which inform experiments. Experiments produce observations, which are used to modify the hypothesis.

Anatomy of a Hypothesis

Basic-science research deals with how things work. Clinical research, on the other hand, aims to draw inferences from basic-research findings.⁴

This article focuses only on basic-research hypotheses. Although it is beyond the scope of this article, I could argue that all hypotheses share the same anatomy and essential purpose; because clinical research often benefits from the application of basic-science findings,^{5,6} meaningful communication of clinical research also benefits from a working knowledge and appreciation of the process of basic science.

In basic science, a hypothesis is a statement of explanation for an observation¹⁻³—elegantly described by Francois Jacob as the *invention of a possible world*.⁷ Let's say that you make the observations that bacterium X makes mice sick and that many genes in this bacterium appear to code for toxins. A very broad hypothesis is that *toxins made by bacterium X make mice sick*. A more specific (and more directly testable) hypothesis is that *gene A (a suspected toxin gene) in bacterium X produces a toxin that makes mice sick*. A number of predictions and experiments follow logically from this hypothesis (Figure). For example, you could predict that in the absence of gene A, bacterium X will not make mice sick. The experiment then is to inactivate gene A and infect mice with this altered form of bacterium X; the hypothesis would be supported if the mice did not get sick. For a more philosophical discussion on validating hypotheses, I recommend Francisco Ayala's "Darwin and the scientific method."¹

In the rest of this article, I hope to demonstrate how the term *hypothesis* is misused in publications and to offer some concrete suggestions and best practices for how medical writers and editors can help authors effectively communicate their hypotheses.

A Hypothesis Is Not a Prediction

In my experience, many authors phrase their hypothesis as a prediction. However, remember that you make predictions and perform experiments based on a hypothesis, which is based on observations³ (Figure). Consider this example from an article in the *Journal of Bacteriology*:

*The pleiotropic effects of ybeY loss on cellular RNAs have been well documented in other bacteria [references], and as such, we hypothesized that deletion of ybeY would lead to changes in mRNA levels in B. abortus. Therefore, we employed microarray technology to identify mRNAs that are influenced by YbeY.*⁸

Here, the sentence opens with an observation that, in other bacteria, the loss of *ybeY* affects RNA. Next is the prediction that deleting *ybeY* from *B. abortus* would affect mRNA levels,

followed by a description of the experimental approach. In fact, I argue that this passage doesn't contain a hypothesis at all.

As an editor, I can transform this prediction into a hypothesis with the following revision (underlined):

The pleiotropic effects of ybeY loss on cellular RNAs have been well documented in other bacteria [references], and as such, we hypothesized that YbeY modulates mRNA levels in B. abortus. Therefore, we employed microarray technology to identify mRNAs that are influenced by YbeY in B. abortus.

In this case, I inferred the hypothesis based on the stated observation, prediction, and experimental approach. However, I would also query the author to make sure that my interpretation is correct.

In the next example, from *Free Radical Biology and Medicine*, the authors predict an experimental outcome based on a hypothesis that is not stated until later in their paper. Here is the prediction disguised as a hypothesis:

*We hypothesized that the AS52DKO cells, which lack the ability to repair oxidative lesions, would be more sensitive to PQ [paraquat] exposure.*⁹

The phrase "would be" makes this statement a prediction about the outcome of an experiment testing sensitivity to PQ exposure. Here is their actual hypothesis:

*... the hypothesis that the PQ mutagenesis is dependent on the generation of ROS and oxidative-stress induced DNA damage.*⁹

The real hypothesis is easy to identify because it describes a mechanism by which cells are damaged by PQ—via reactive oxygen species (ROS) and oxidative-stress-induced DNA damage. In this case, accurately stating the hypothesis from the start helps guide the reader through the narrative. Here is one possible revision:

We hypothesize that PQ-induced mutagenesis depends on the generation of ROS and oxidative-stress-induced DNA damage. Therefore, we predicted that the AS52DKO cells, which lack the ability to repair oxidative lesions, would be more sensitive to PQ exposure.

Write in the Present Tense

A hypothesis explains an observation—something that is occurring here and now. Therefore, phrase hypotheses in the present tense.³ Here is a good example from the *Journal of Bacteriology*:

*We hypothesized that S. aureus utilizes fatty acids present within lipoprotein particles. To test this hypothesis, we monitored the sensitivity of S. aureus cultured in the presence of human LDL to the FASII inhibitor triclosan.*¹⁰

In the first sentence, the authors state their hypothesis—their explanation of how *Staphylococcus aureus* can source fatty acids when its own fatty acid synthesis pathway is inhibited by triclosan. Note their use of “utilizes” in the present tense. In the second sentence, the authors describe their experimental approach that follows from this hypothesis.

Here is a second example, also from the *Journal of Bacteriology*:

*Analysis of the known SpoVG-binding sites has not revealed any obvious consensus sequence; therefore, we hypothesize that SpoVG may interact with certain nucleic acid structural motifs rather than a particular nucleotide sequence.*¹¹

The authors first describe their observation that SpoVG-binding sites do not contain specific nucleic acid sequences. This observation leads to the hypothesis that SpoVG instead interacts with specific nucleic acid structural motifs.

Be Confident

The second example just above raises another point—be confident in your hypothesis (regardless of the outcome). The authors stated that “SpoVG *may* interact.” Although “may” is a modal verb that can express the possibility of something occurring (likely the authors’ intention), it can also communicate a lack of confidence. If the authors don’t appear confident in their hypothesis, why should the reader be confident in it? Likewise, why should the reader be confident in the experimental design and results? Here’s an example from *PLoS Pathogens*:

*Given that neutrophil recruitment is a major effect of IL-17, we hypothesize that the role of this cytokine in host defence against a particular pneumococcal strain may critically depend on the resistance of the strain to neutrophil phagocytosis, and hence on its degree of encapsulation.*¹²

The authors hypothesize that “the role of this cytokine ... may critically depend.” Again, the word “may” leaves me feeling uneasy. Rewriting this as “the role of this cytokine ... depends critically” conveys confidence on the part of the researchers. Most likely, authors write this way to hedge their predictions. This is understandable and appropriate when drawing conclusions about experimental results, but remember that a hypothesis is made to be tested. In fact, disproving a hypothesis is an important part of the scientific process—not something to fear.

When authors tell a story with confidence, the reader has more confidence in them and their data—and thus in how they interpret their results. Isn’t that a good thing?

Don’t Hypothesize About Impact

I find that authors often hypothesize about the impact of a study. The following example is from the abstract of a paper

about Duchenne muscular dystrophy (DMD) published in *Medical Hypotheses*:

*We hypothesize that precise genetic editing in iPSC [induced pluripotent stem cells] using CRISPR-Cas9 technology, coupled with MPC [myogenic progenitor cell] differentiation and autologous transplantation, can lead to safe and effective muscle repair...*¹³

This is clearly not a hypothesis (an explanation for an observation); rather, it is a prediction about the outcomes of the proposed work. One strategy is simply to remove the term “hypothesis” and rewrite the beginning of this sentence as “we predict that precise genetic editing ...” This abstract goes on to state that

With future research, our hypothesis may provide an optimal autologous stem cell-based approach to treat the dystrophic pathology and improve the quality of life for patients with DMD.

At first glance, the statement seems reasonable, but isn’t it actually illogical? The hypothesis itself cannot *provide* a therapeutic approach. Instead, it is the experimental results that may guide research to develop treatments for patients with DMD.

No Hypothesis? That’s Okay

Finally, it’s not always possible to state a hypothesis—take hypothesis-generating research as an example.¹⁴ In my experience, there seems to be an unwritten (undeserved) rule that such work is not valuable, possibly prompting authors to state a hypothesis that is not really there. Here is an example from a paper in *Microbiome* in which the authors surveyed the caecal microbiome of chickens to identify microbes that might influence the animals’ health and productivity:

*Our hypothesis was that the caecal lumen microflora would vary significantly between chicken breeds and lines, offering opportunities for targeted genetic improvement by selective breeding.*¹⁵

The authors are doing this work to make an observation—to define a phenotype that can be investigated further. Essentially, their hypothesis is that they will make an observation, but doesn’t that go without saying? It is only after they make their observations that they could generate a hypothesis to test experimentally (Figure).

The Medical Writer’s Role

If the hypothesis is important to people doing research, then it should be important to people writing about it. In my experience, one can usually infer the author’s hypothesis and revise the text accordingly (with a comment that the author check for

accuracy). If the medical writer does not feel comfortable with the subject matter, it is nevertheless possible to restructure the text so that the author can fill in the gaps.

We medical writers are not experts in every subject, but we can judge whether a stated hypothesis is *really* a hypothesis (independent of whether it is a *good* hypothesis). This skill can go a long way in helping authors report clear, robust research to their audience. After all, isn't that our goal?

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Many Papers Written; Not So Many Published



- Up to 3 million scientific papers are written each year, often without a clear path to publication.
- Data from 54% of US government-funded clinical trials are not published in indexed journals within 2.5 years.¹
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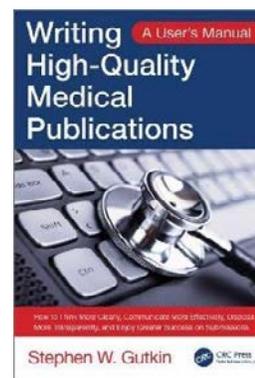
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Brian Bass



Melissa L. Bogen



Lori De Milto



Gail Flores

Q What is your strategy for approaching a potential new client when you don't know anyone in the organization, even when no ad or opening has been posted?

A I've gotten many steady, stable, high-paying clients who treat me right through direct email. This strategy focuses on helping prospective clients solve their problems, instead of trying to sell my services. Direct email is customized to each prospect. You use language from the prospect's website to show you understand the prospect's needs, greet the contact person by name, and use the organization's name in the subject line and the email.

A compelling, client-focused subject line is key (but write this last). After the greeting, write a sentence showing that you understand the organization's needs and 1 or 2 sentences about your most relevant experience. Include a link to your client-focused website (or your client-focused LinkedIn profile if you don't have a website yet) and a call to action that clearly says what will happen next (eg, "Should we schedule a call next week to discuss this?"). Now go back and write your subject line.

If you don't hear back from the contact person in about a week, send a polite, professional follow-up. Most responses come from the follow-up emails. Other names for what I call direct email are warm email prospecting, cold emails, or sales emails. Whatever you call it, direct email is a proven way to get steady, stable, high-paying clients.

— **Lori De Milto**

Before approaching a prospective client who is unknown to you and has not been referred by a mutual acquaintance (this is known as a "cold call"), you should make a list of such prospects and include their medical specialties, therapeutic areas, or products and pipelines that correlate with your background and experience. Best not to make a cold call to someone if your expertise is irrelevant to their business!

I always try to get the name of a manager in the specific department(s) I wish to contact, regardless of whether the prospect works for a pharmaceutical/biotech company, hospital marketing/public relations department, managed-care company, university, or a third-party agency (eg, CRO, ad agency, MedCom agency, sales training, or CME company).

If possible, it's best to get names from friends/colleagues so that you don't have to make a 100% "cold call"; instead, you can make a "warm call" and say that so-and-so suggested you call. One simple way to do this is to send out a global email to all of your contacts/colleagues to let them know you are seeking X types of projects and inquire whether they know anyone who may need your services. Include a resume and ask them to pass it on to colleagues. If this is not possible, or if yields no results, then search your target companies' websites and social media sites for relevant names.

Certainly, I Google for lists of different types of organizations likely to hire medical writers/editors (eg, CME companies, contract research organizations (CROs), MedCom agencies, public health, and nonprofit agencies). Lists like this are readily available and often include names and emails/telephone numbers.

Ideally, I wish to obtain the person's direct email address and phone number so that I don't have to start the email with "Dear sir." I also make sure to include a brief description of my background in the email, highlighting projects most likely to be relevant to the specific person/company.

If a company requires that human resources (HR) be the first line of contact, then I usually try to get the HR person's name. (Cold calls to anonymous HR departments may be common when seeking a full-time job, but they are not great for a freelance/consulting project.)

I also have contacted both potential and former clients via LinkedIn or direct telephone call (and even, on occasion, snail-mail). Don't be afraid to make a cold call by telephone, as it is an excellent medium! Today, email and social media are more acceptable and more likely to generate a reply, but some people actually do answer the telephone; in my opinion, the only better way to qualify a prospective client is with face-to-face contact.

If you have a B2C business, then using Facebook and Instagram (and other social media) is advisable; my business is B2B, so I use LinkedIn. (However, I plan to establish a B2C subsidiary business and will be using other social media for business, probably including YouTube.)

Sometimes I have spent a full day just prospecting, qualifying, and contacting potential clients. It's important to remember that sales is an essential part of being a freelance and we all have to do it. I have often said that being a good

salesperson means learning “the art of handling rejection.” Sometimes it’s difficult, sometimes it’s fun—but it is always necessary.

— Cathryn D. Evans

Q Is there an ideal number of regular clients for a freelance? In balancing regular client work with the occasional project, what is the best mix?

A There’s no ideal number of clients for a freelance, but it’s crucial to have a few anchor clients. These are steady, stable, high-paying clients who treat you right. I’ve always had 2 or 3 anchor clients and make about 75% of my annual income from these clients. My other clients include 1 or 2 small, steady clients; 1 or 2 clients who hire me a few times a year; and an occasional 1-project client. So, my mix is 75% anchor clients, 20% small but regular clients, and 5% occasional clients.

In a given year, I usually work with about 7 or 8 clients. That’s probably fewer than many freelances. If you’re still exploring freelance opportunities and building your business, you’ll want more clients. But once you figure out the type of work and clients you like best, it’s much easier and more profitable to work with a few anchor clients and a few other clients each year.

— Lori De Milto

The ideal number of clients a freelance should have is as many as value you, pay you well, love working with you, and consistently bring you new work. It should always be more than 1 client because you should never put all your eggs in 1 basket. But it can be as many as you like, as long as you can keep up with doing top-quality work for all of them.

The number of ongoing clients I’m currently working with is 3, only because a few regular clients have been on the quiet side for the past couple of months. That’s one of the many reasons you need to have a group of clients! In addition, within the past few weeks, I’ve started and completed projects for 2 new clients I had never even heard of a month ago, and I have estimates out to 3 companies I’m hoping will soon become new clients. That’s in addition to estimates I have out for new work with ongoing clients.

Rather than look (or hope) for a specific number of clients or a specific mix of regular and new clients, I’m constantly marketing my business and doing my best on every project, so new work constantly comes to me. I don’t turn any project down unless there’s no way I can get it done within the

required time, it doesn’t fit well with my expertise or the expertise of someone on my team, or the client’s budget is too low for us to charge for the value I/we bring to the table. But I do turn away clients if it’s not a good match or if my gut tells me it’s not going to be a good experience.

In fact, I just turned away a prospective new client this morning before I sat down to write this. It was clear from their communications and the project information they provided that they were looking for a drone to crank out a widget. They didn’t value the talent and expertise a professional medical writer brings to the table, and that’s not a client for me.

— Brian Bass

Although I don’t have an ideal number of clients, I do have a comfort zone. I quantify my number of clients in 2 ways: the number of clients I have at a given time and the number of clients I have in a calendar year.

I frequently work on multiple projects with a single client. For the purposes of this article, I’m equating the number of clients I have at a given time to the number of projects I have at a given time. I book overlapping projects to maintain a relatively steady income stream. I’m most comfortable when I’m working on 2 to 3 writing projects at a time, along with a constant flow of manuscripts from an editing client. Working on more than 1 project at a time allows me to switch to another disease state or type of work when I like. Although deadlines ultimately drive my project prioritization, it’s nice when I can choose to work on whatever I’m most in the mood for at the time. Even when I have a rare day in which I can focus on just 1 project or deadline, I still need to keep tabs on other projects by managing emails, schedules, and phone calls. Thus, I find that having more than about 4 overlapping projects starts to get too busy with respect to administrative tasks and the mental energy required to ensure I’m on top of everything.

I quantify the number of clients I have each year by the number of 1099 forms I get, which is usually between 6 and 10. To maintain a healthy freelance business, it’s important to diversify but not to overextend. Having fewer than 6 clients a year, even awesome clients, might indicate that I’m putting my business eggs into too few baskets. Clients retire, shutter their doors, or otherwise disappear. Therefore, it’s good to have enough clients to buffer against a sudden loss of any one of them. On the other hand, having too many clients might indicate that I’m spending my time working on a large number of smaller projects and that I’m spreading myself too thin, especially considering the time spent on the administrative tasks, emails, and other work required to maintain a large number of clients.

— Gail Flores

Q How do you tell a good freelance writing or editing opportunity from a bad one? What are some “red flags” to look for in a new opportunity?

A First, let's define “good” versus “bad” freelance editing opportunities.

Good freelance editing opportunities have several factors in common:

- The client is pleasant and responsive to email.
- The client answers all my questions.
- The contract or email agreement specifies the tasks to be completed (also known as the “scope” of the project).
- The agreement specifies my rate or fee and payment time (ideally net 30 days).
- The material is sent to me on time and complete, without missing pieces, or the client sends missing pieces promptly, so the project is not held up.
- The deadline is specified and realistic and changes as required if the client sends material late.
- The client trusts my judgment, and we have collaborative discussions about the project.
- The client is open to renegotiating the fee if the project scope changes substantially.
- A “one-off” project leads to continued assignments.

Most of my work comes from referrals, which is a good way to weed out “bad” editing opportunities. At the very least, colleagues know to refer work only from clients who pay promptly at the agreed-upon time. We generally discuss client personalities, work style, business ethics, etc ahead of time so I can discern whether the potential opportunity falls within my business model.

Referrals allow me the chance to know ahead of time what I'm committing to; all of my assignments that have come from referrals have been good editing opportunities.

Bad freelance editing opportunities have myriad problems. Here are just some of their characteristics:

- The client is an individual, not a company, and contacts me after searching the internet or seeing my profile on 1 of the freelance directories in which I have a listing. Some editors have successful business models working for individuals, but in my experience, individuals who contact me out of the blue invariably are looking for an inexpensive editor who will do an overload of tasks in an unreasonable amount of time. Such individuals often abruptly disappear when I tell them my rate, or they try to get me to lower my rate. I call these people bargain hunters or “tire kickers.” I take work from individual authors only if a project interests me greatly because such clients rarely pay well.
- The client is rude, abrupt, or takes a long time to answer emails.

- The client doesn't answer all my questions.
- The client asks me to lower my rate.
- The client asks for an unreasonable number of tasks to be done in the allowable time.
- The client acts as if they have hired me to be “on call,” as if I am available at a moment's notice, after usual business hours, on weekends, or at the last minute. I do work under those conditions, but only when I choose to do so for known clients who are compensating me for going that extra mile. A freelance is not an indentured servant.
- The payment deadline is longer than 60 days, or the client is unable to give me a specific time frame for payment. Any client looking to hire a freelance should be aware of their company's payment practices.

In summary, the best freelance editing opportunities come from referrals, and the worst ones come from unsolicited individuals contacting me out of the blue.

— **Melissa L. Bogen**

The saying goes, you have to kiss a lot of frogs before you find a prince (or princess). In my experience, there aren't as many bad clients or bad freelance opportunities out there as you might think. But that doesn't mean a bad one won't kill you. It only takes one! In my response to the previous question, I mentioned a potential client I just turned away this morning. I'll concentrate my response to this question on that experience because it's very fresh in my mind.

Someone with whom I've worked in the past who recently joined the company referred the client to me. (There's an additional complication I'll get to in a moment.) I had a great working relationship with this person and her previous employer, and she knows how I and my team work and that we do a great job.

Fast forward... The first email I receive from the contact at this new company starts off great—“We're looking for expertise in this and that therapeutic area,” “We need support through the fourth quarter of the year.” Great! I send details about relevant therapeutic expertise. The next email I receive is about a specific assignment. Also great! It identifies 2 learning modules, provides specific dates for content development and reviews, and includes the amount of time “someone” has decided the work should take. The hair stands up on the back of my neck. No concern, not even a word, is given to what the project is or what actually needs to be done.

Against my better judgment but being careful not to reflect badly on the colleague who referred me, I ask a few questions about the nature of the project so I can develop an estimate (completely disregarding their designation of hours, to which I have no intention of paying attention). “The project is ready now.” “We need someone to get started right away.” “Just follow the outline that will be provided.” “No ‘creativity’ (her quotation

marks) required.” This is what a red flag looks like, folks! This is a big red flag!

This is a perfect example because what I will tell you next raises just about every other red flag you can imagine. First, I’ll back up to the master service agreement they asked me to sign before we even got to this point. It literally had a clause telling me that I wouldn’t be paid until 60 days after invoice, and then only provided their client had paid them first, and that if their client didn’t pay them, I would have to go after their client for my money. I deleted that and a lot more from the contract and they agreed to all my changes. What were they hoping to get away with? Red flag!

Back to the story, I continued on with the email conversation only because I was looking for a tactful way of ending it. They gave it to me, although I can’t say for certain that my last email to them was tactful. It certainly was indisputable. In answer to my repeated request for more information about the actual project—not their expectations for the project—I received a project brief. That brief put the fork in it for me. It was done. The brief still provided no tangible information about the project. But in addition to repeating the number of allotted hours per step, the brief also dictated an hourly rate that is far below what any experienced professional medical writer should be paid IF they work for an hourly rate (which they shouldn’t) AND a total project budget that was nothing short of unrealistic and offensive. I responded that I do not work on an hourly basis, so I saw a fundamental problem. I went on to say that for me to prepare a project estimate for this assignment, I would need a more complete description of the work involved and asked whether that was possible. I concluded by writing that if the total cost is firm, I’m afraid I wouldn’t be able to assist them.

That was the end of it. I sent a follow-up email to the colleague who referred me, tactfully and generally explaining that the relationship wouldn’t be a good fit and that I was sorry and hoped it would not reflect badly on her. I added that I still look forward to the opportunity of working with her again.

— Brian Bass

The 3 things I need for an opportunity to be a good fit is for the work to be interesting and/or enjoyable, for the pay to be good, and for the client to treat me well. I can be somewhat flexible with 1 of these at a time, but if any are way off, then I’m out. For example, if the work is fantastic and the pay is amazing, I can handle a slightly irritating client—but not one who lacks respect for me.

When considering a new opportunity, the most important red flags are those that trigger my gut instinct. If my gut tells me “no,” I turn down the project! Turning down work that doesn’t sound like something I’ll enjoy or that doesn’t pay well is easy. Identifying clients that won’t treat me well is more difficult. Client behaviors during the project negotiation and

initiation phases that are red flags include disorganization, inflexibility, and rudeness. Difficulty in agreeing on a fee is also problematic—a client who nickels and dimes during the negotiation phase will likely also be difficult if the project goes out of scope. Finally, if a client mentions that 1 or more previous writers did an inadequate job on the project yet can’t explain why, there’s a good chance that the client doesn’t actually know what he or she wants. I wouldn’t walk away from a client like this—I’d run. A client who doesn’t know what they want is a recipe for an exponentially growing disaster characterized by additional drafts, scope creep, anger, and frustration.

— Gail Flores

Media Reviews *continued from page 75*

Moving on to the actual structure of the paper, *The Guide* describes in succinct but complete detail how an author should construct Methods and Results sections, giving practical advice, such as what to include, paragraph structure, how long these sections ought to be, and where to put auxiliary information. Readers are reminded of easily overlooked syntactical tips, such as proper tense selection, unit selection, and the interplay between visual aids and text.

Next, the Introduction of a paper is discussed, including what this section is meant to do (such as defining the gap in the current knowledge), how to structure it, outlining the hypothesis, and defining the background and aims of the study. The Discussion section is laid out as the place where writers describe how their study fits into the greater topical field. *The Guide* offers tips on how to present a discussion of the strengths and limits of the study and how to give a concrete answer to the research question posed.

After a brief discussion of crafting the Abstract and carefully choosing a title, *The Guide* moves on to handling presubmission tasks, submitting, and postsubmission work. It grounds the reader in the process of publication by explaining—stepwise—all of the tasks that go into submitting an article. It provides practical details, such as overall format, how to decide who the lead author will be (if applicable), how to handle requests for revision, and how to interpret specific editor notes and requests.

In sum, *The 21st Century Guide to Writing Articles in the Biomedical Sciences* provides a straightforward, concise guide for any medical writer. With jargon-free language, the text not only will be accessible to the inexperienced writer but also will provide a practical reference for the well-seasoned writer. The information is accurate and up-to-date, with many useful online and free resources identified that will make the writing and publishing process easier. Although not encyclopedic in scope, this book is an excellent resource to help all levels of writers attain their goals of publication.

Reviewer: Mark Youssef

Mark Youssef is a medical doctor practicing in Cincinnati, Ohio.

FROM THE PRESIDENT

We're On a Mission



Cynthia L. Kryder, MS / 2018–2019 AMWA President

“Change the way you look at things and the things you look at change.”

—Wayne W. Dyer

I attended my first AMWA Board of Directors (BOD) meeting in 2010 when I served as Chapter Delegate for the Delaware Valley Chapter. I recall sitting in a meeting and listening to board members update the group on routine AMWA business. We covered a lot of ground as we moved through a traditional consent agenda focused on reviewing and approving meeting minutes, financials, committee reports, and volunteer and committee appointments. Nine years ago, that was the way associations got things done and I'll confess it was mind-numbing.

Fast forward to 2019 and best practices have evolved. Rather than spending valuable time describing work that has already been completed, experts recommend developing strategic board agendas that use strategy to inform discussion and decision-making. At our April BOD meeting, we did just that: we flipped the agenda around so that the meeting began with discussions about AMWA's content and member-resource strategies, two mega-issues affecting the association, and ended with routine board business. This change allowed the board ample time to focus on strategy, policy, and oversight and enabled a rich discussion with clear direction toward achieving our priorities while remaining fiscally responsible.

Our board discussions in the spring confirmed that our highest priorities are to enrich AMWA's content and community by

- Enhancing education and resources
- Increasing program participation
- Supporting chapter leaders

Enhance Education and Resources

We had a robust discussion about new educational initiatives, member resources, and content creation. Figure 1

highlights the initiatives we are undertaking to enhance our educational activities and create more resources for our members, including ways to improve the production of the *AMWA Journal*.

Plan and promote 2019 Conference in San Diego

Promote results of Compensation Survey

Develop process to create new educational programs and resources based on documented needs and feedback from employers

Recruit, vet, orient, and train new subject matter experts/faculty members

Plan and promote 2019 Executives Forum

Improve *AMWA Journal* production process

Figure 1. Educational and resource initiatives.

AMWA's salary survey data are one of our key resources. For our 2019 Compensation Survey, we exceeded our goal in terms of the number of participants who completed the survey. Thank you to everyone who took the time to participate in the survey. I'd also like to thank Joanne Rosenberg, who led this initiative, and members of the task force who worked efficiently to ensure we met our deadlines. We are now in the process of analyzing the results, and we'll promote the results as soon as we finish the analysis.

Since January, work in the Education Department has focused on top priorities: creating a comprehensive

educational curriculum, expanding the pool of workshop leaders, and developing new educational activities—especially ones that meet the needs of mid-level medical communicators. I'm thrilled to report that we have recruited 24 new faculty members, allowing us to debut 6 new workshops at the 2019 Medical Writing & Communication Conference in San Diego, with other new or substantially updated workshops in development for 2020 and beyond (Table 1). Topics were selected based on documented competencies and needs, with input from executives who hire and manage medical communicators, whom we initially engaged at the 2018 Executives Forum and will continue to engage in 2019.

AMWA workshops are designed to deliver education in an immersive experience that is an equal blend of lecture and hands-on application of practical skills and knowledge. We are currently reviewing our 121 distinct workshops to ensure they continue to be relevant and up-to-date. Through this Workshop Revitalization Project, we aim to update content, remove stale or vague titles and descriptions, and ensure each workshop includes adequate learning objectives.

As if that weren't enough, the Education Department also is in the process of creating an exclusive, members-only resource library in response to your requests for more resources on guidelines, standards, and templates. This repository will comprise nearly 100 resources and should be available by September 2019.

Increase Program Participation

We also devoted time to discussing strategies to make members and prospective members aware of AMWA's resources. The BOD recognizes that it's not enough to create new content. We need to make people aware of our association and all we have to offer. Consequently, AMWA has made new investments in marketing and promotion (Figure 2). In January, AMWA engaged a marketing firm to help develop and implement an inbound marketing program, a technique for creating awareness of AMWA via content marketing, social media marketing,

Table 1. New Workshops in Development and Planning

Topic	Professional Area
<i>To debut at 2019 Conference</i>	
Lean authoring	Regulatory
Best practices for writing needs assessments	Continuing medical education (CME)
Writing for visual media	Writing/editing
Lay summaries	Regulatory
Development of journal manuscripts	Scientific publications
Editing clinic	Writing/editing
<i>In development</i>	
Literature search strategies	Universal
Conducting a literature review for needs assessments	CME
Writing for mobile learning	CME/universal
Principles and practices of mentoring	Regulatory
Development of safety update reports	Regulatory
Thinking and writing visually	Universal
Best practices for writing test items	CME
Creating posters	Scientific publications
Developing sales training materials	Other

and search engine optimization. This investment will enable us to better promote AMWA's value.

Implement inbound marketing initiative

Apply content marketing strategy to increase awareness of AMWA

New educational content development

Figure 2. New investments in marketing and promotion.

Support Chapter Leaders

Figure 3 outlines our chapter support initiatives. Staff continues to work with chapters to revise chapter bylaws, and in April the BOD approved revised bylaws for 5 chapters. We're also in the process of promoting the resources we have created for chapter leaders, such as checklists and planning guides, as well as the Chapter Officer Community on Engage, where chapter leaders can discuss concerns and share resources. (If you haven't done so already, take some time to view the Roadmap to AMWA Chapter Success infographic at

- Guide implementation of new chapter bylaws
- Promote new chapter resources
- Implement new chapter officer orientation at conference
- Support development of a new PacSW Chapter

Figure 3. Chapter support initiatives.

https://www.amwa.org/resource/resmgr/membership/chapter_leader_tools/roadmap.pdf. We're also in the midst of planning a face-to-face chapter leader orientation, a new event at the 2019 conference.

Perhaps the most exciting news with regard to chapters is the revival of the Pacific Southwest (PacSW) chapter! I'm pleased to tell you that the BOD approved a resolution granting a 90-day provisional period for chapter officer candidates in the PacSW area to complete the business registration and incorporation requirements to establish a new chapter. Thank you to the 4 officer candidates spearheading this effort:

- President: Kate McKiernan
- Vice President/President Elect: Andra Steinbergs
- Secretary: Molly Powers
- Treasurer: Sigrid Nelson

Yes, it was a productive and energizing BOD meeting. I'm so glad we were able to harness the collective wisdom and experience of our directors to develop a strategy that will enable AMWA to move forward in its mission: "To promote excellence in medical communication and to provide educational resources in support of that goal."

Annual Financial Report, 2017–2018

Julie L. Phelan, MD, MBA / 2018–2019 AMWA Treasurer

It has been my pleasure to serve as treasurer for the American Medical Writers Association (AMWA) over the past year. I am pleased to present this financial report for the fiscal year ending June 30, 2018.

During this year, AMWA continued to dedicate resources to enhance educational opportunities for medical communicators across settings and career levels and to increase awareness of AMWA as a valuable resource for medical communicators.

Financial Performance

AMWA began and ended the fiscal year in a strong financial position and continues to invest in new education and marketing initiatives so that members are aware of and have access to relevant and timely education and resources.

AMWA's net income for the fiscal year was \$257,161, with significant investment gains contributing to the results.

Revenues

AMWA's program revenue for the fiscal year was \$1,714,023. Membership, the annual Medical Writing & Communication Conference, and education program income continue to be AMWA's major sources of revenue. Together, these programs provided 89% of AMWA's program revenue for the year. Net investment income accounted for \$120,093, representing 6% of AMWA's total revenue for the year.

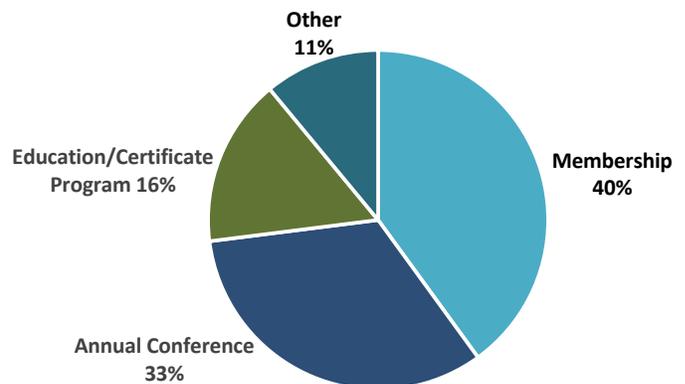


Figure 1. Sources of program revenue for the fiscal year ended June 30, 2018.

Expenses

Throughout the year, AMWA invests in programs, products, and services that provide value to members and the medical writing community. Total program expenses for the fiscal year were \$1,664,872, with 26% of the expenses being used to fund planning and production of the annual Medical Writing & Communication Conference, 26% of expenses being used to fund member services and benefits, and 13% of expenses being used to fund the education program, which includes the certificate and online education programs.

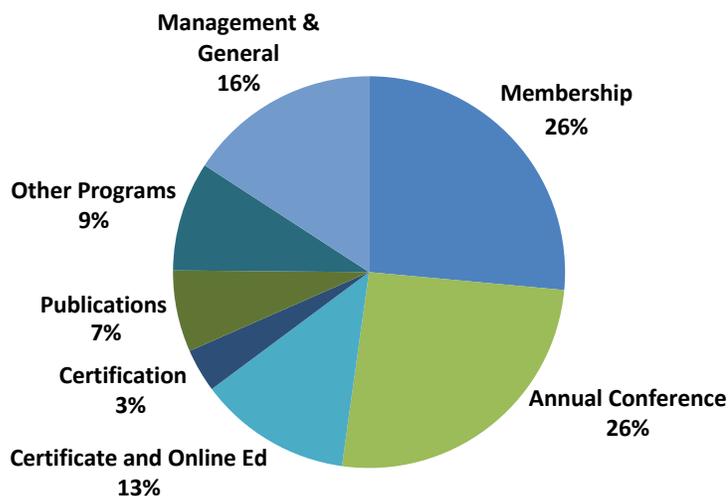


Figure 2. Sources of program expenses for the fiscal year ended June 30, 2018.

Reserves

Reserves are the accumulation of funds over time that enable the organization to withstand an emergency or to invest in new programs. Unrestricted reserves sufficient to fund 6 to 12 months of annual operating expenses represent a standard target for not-for-profit organizations. With budgeted annual operating expenses of \$1,821,850 for the fiscal year from July 1, 2018, to June 30, 2019, the 6- to 12-month targets for AMWA's reserves range from \$910,000 to \$1,820,000. AMWA's unrestricted short- and long-term investment reserve level of \$1,644,076 on June 30, 2018, was within the targeted range. AMWA's restricted Endowment and McGovern funds totaled \$187,200 and \$155,365, respectively, as of June 30, 2018.

Financial Position

An organization's financial position is reflected in its asset and liability holdings. AMWA is well positioned to pay its obligations and invest for the future. Total assets were \$2,720,733 as of June 30, 2018, and the organization's liabilities totaled \$840,442.

Conclusion

Abercrombie and Associates, AMWA's independent auditor, expressed an unqualified opinion regarding its audit of the financial statements for the fiscal year ending June 30, 2018. The full audit report is available to AMWA members upon request. An unqualified opinion states that the financial statements present fairly, in all material respects, an entity's financial position, results of operations, and cash flows in conformity with generally accepted accounting principles. AMWA continues to be in a secure financial position as it continues expanding member benefits and resources into the next fiscal year.

Acknowledgment

I thank Calibre CPA Group PLLC for providing the financial data and the members of the 2017–2018 Budget and Finance Committee for their review of reports and budgets: June Baldwin, Adriana Caballero, Alice Pappas, Whitney Smalley-Freed, Kristina Wasson-Blader, and Christine Wogan (and ex officio members Kathy Spiegel, Cyndy Kryder, and Susan Krug).

Author contact: Julie@biomedisysinc.com

De-myth-tifying the MWC

The Medical Writing Certification Commission

Medical Writer Certified (MWC[®]) certification is about to celebrate its fourth birthday. Launched in December 2015, the MWC certification has been earned by more than 70 medical communications professionals. Employers are starting to include MWC certification in their job postings. Sitting for the exam is now more convenient than ever, with 218 IQT testing centers across the US and more located around the world. The number of people sitting for the MWC exam continues to increase each time the exam is offered. So why are there still myths about the MWC?

With this article we hope to de-myth-tify the MWC.

Myth #1: The MWC is a medical writing certificate.

No, it is not. The MWC exam is a certification exam, not a certificate, and the difference is important. A certificate is granted upon completion of an educational process, whereas you become certified by completing an assessment process. Whereas you can list a certificate on your resume or CV, certification typically results in a designation or credential to use after your name (in this case, MWC[®]). Certification typically requires some amount of professional experience, whereas a certificate is appropriate for both entry-level and experienced professionals. Also (and this is very important), certifications like the

MWC have ongoing requirements in order to be maintained, and the holder must demonstrate that she/he continues to meet those requirements in order to maintain the certification. A certificate is an end result—a document that demonstrates knowledge of course content at the end of a set period of time.

Myth #2: The MWC is a regulatory exam.

No, it is not. Many people—particularly those who don't write in the regulatory environment—think (or fear) that the MWC exam is a "regulatory" exam. It's not. But neither is it a "CME" exam, a "publications" exam, a "sales training" exam, a "patient education" exam, etc. Unlike AMWA, other organizations (such as the International Society for Medical Publication Professionals [ISMPP] or the Regulatory Affairs Professionals Society [RAPS]) are vertically oriented to a specific type of writing. AMWA is the organization where all professional medical communicators find a home regardless of the specific area(s) in which they work. For this reason, the MWC exam assesses whether candidates possess the foundational knowledge, skills, and abilities (KSAs) required to be a professional medical writer regardless of what type(s) of writing they do.

Myth #3: To pass the MWC exam you have to know everything about everything.

Definitely not! Although having a basic high-level understanding of the different areas of medical writing certainly may help, as mentioned previously, the MWC exam assesses whether you possess the foundational KSAs required to be a professional medical writer regardless of what type(s) of writing you do. Five KSAs are assessed by the exam:

- Your ability to **gather** the information you need from the sea of possibilities
- Your ability to **evaluate** the information you've gathered to determine its validity and usefulness
- Your ability to **organize** the information you've evaluated and determined meets your needs into a cohesive message
- Your ability to **interpret** the message you've organized to make it meaningful to your audience
- Your ability to **present** a meaningful message clearly, concisely, and accessibly for the intended audience

Exam questions span all 5 KSA domains in these approximate percentages as noted in the Examination Content Outline within the Examination Candidate Study Guide: gathering (16%), evaluating (19%), organizing (19%), interpreting (19%), presenting (27%).

The questions that assess these domains do so across a range of subjects representing the diversity of medical writing. So, in any given exam there may be questions on statistics, ethics, guidelines, regulatory writing, publications, continuing medical education, writing for consumer audiences, grant writing, and more. Within the Examination Candidate Study Guide you'll find example topic and subtopic categories and a list of selected examination preparation resources that is categorized according to the KSAs assessed by the exam.

Myth #4: There's a "right way" to study for the MWC exam.

Absolutely not! There isn't a right way, or for that matter a wrong way, to study for the MWC exam. The best way to study is your way.

Some people have found it helpful to review their notes from the AMWA workshops and open sessions they've attended over the years. Others have found targeted internet searches helpful. Some people review, or re-review, AMWA's Essential Skills self-study workbooks (https://www.amwa.org/page/Essential_Skills). Some people simply hit the books like in their university days, whereas others have formed study groups.

Unsurprisingly, most people find the Examination Candidate Study Guide very helpful when it comes to planning their study strategy. Taking the sample exam in the guide may help you identify weak areas toward which you may want to direct your attention. The list of suggested preparation resources may be valuable for identifying specific study tools. Or you can wing it, which some people have done as well. However, the MWC Commission highly recommends preparing for the exam.

On the next page you can read study tips provided by people who have sat for the exam and earned their MWC certification. These tips underscore the diversity of approaches to studying for the exam, each of which worked for the particular person. Studying for the MWC exam is really a matter of doing what works best for you.

**ONLINE
EXCLUSIVE**

Read the [2018 Walter C. Alvarez Award Presentation](#)
by Robert M. Califf, MD, MACC.



Study Tips From People Who Have Earned the MWC

“If you’re an experienced writer, you probably don’t need to study much as you’ve likely learned what you need to know on the job. Review the 5 domains covered by the exam and the example questions to help identify any potential knowledge gaps, and study accordingly. For example, I used the book *How to Report Statistics in Medicine* by Tom Lang and Michelle Secic to brush up on statistical concepts. I also reviewed the ICH guidelines and components of the Common Technical Document because I am not a regulatory writer and knew I needed to familiarize myself with regulatory content and terminology. If you’re new to the profession, use the MWC examination domains and Candidate Study Guide as a framework to guide your professional development activities as you gain the required experience to meet the exam eligibility criteria.”

—**Dana Randall, MS, PharmD, RD, RPh, MWC**

“Attend AMWA workshops and review the notes from the workshops.”

—**Deborah Sommerville, MWC, ELS**

“The MWC is not a “regulatory” exam. Don’t be afraid to take it if you are not a regulatory writer. Review basic biostatistics!”

—**Kathy Spiegel, PhD, MWC**

“While my daily work as a writer of patient education materials prepared me well for parts of the MWC exam (eg, writing mechanics, medical terminology, plain language), I had to branch out to learn more about other areas, such as regulatory writing, publication management, and CME. I found AMWA’s Candidate Study Guide hugely helpful in providing an outline of the topics to be covered in the exam, and the example questions were a great way to get a sense of how the exam would be structured. The list of resources provided was also very helpful in that it gave me an idea of where to begin in areas with which I was least familiar (eg, regulatory submissions).”

—**Kelly Crowley, MWC**

“I was familiar with CME, having worked in the industry for 25+ years, so I studied the regulatory information more thoroughly. The example questions were very helpful. Also, it appears that there are now more references and resources available via hyperlink, which would be very helpful to those unable to purchase these sources.”

—**Nancy Lucas, MWC**

“There were excellent resources on the AMWA website to give me an idea of what I was in for and to help me prepare for the MWC exam. The Candidate Study Guide provided advice, the exam content outline, and an excellent set of sample questions along with an answer key that clearly explained the choices. I set up a 12 week self-study syllabus based on the content outline.”

—**Liza Ovington, MWC**

“Obtain all the recommended books/sources suggested by the commission; study with a buddy, create a study plan and meet regularly; and develop practice multiple choice questions—this was the hardest part for me. It’s not just enough to know the content. A person who takes the exam has to respond to multiple choice questions.”

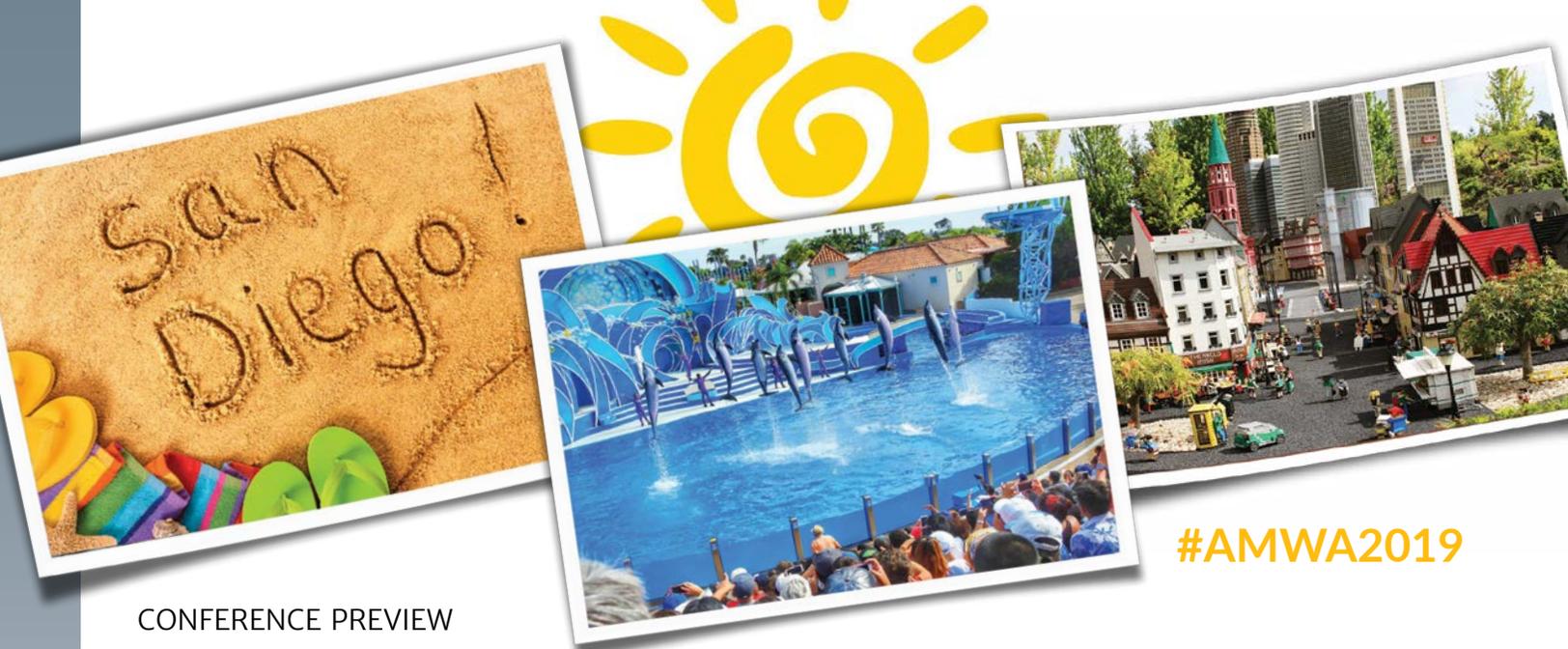
—**Nancy Katz, PhD, MWC**

“About 6 months before the MWC exam, I printed out and reviewed the Candidate Study Guide. I used highlighters to create three categories in the guide based on my level of knowledge: topics I knew well (knowledge and experience); topics I had some idea about (knowledge and no experience or limited practical exposure); and topics I knew nothing about (no knowledge or experience). I reviewed the recommended resources provided in the Candidate Study Guide and purchased some of the resources for the topics that I knew nothing about. I also identified online resources to “brush up” on some topics.”

—**Nola Clarke, PhD, MWC, RAC**

“First, leave yourself plenty of study time...more than you think you will need. Even if you are an expert medical writer, you may find the test covers unfamiliar content that is outside your area of specialization. Second, take the practice test offered in the Candidate Study Guide. Mark the questions where you had to guess or got the question wrong, then find the related study references in the answer key. Third, do a quick scan of the other references on the list. If there are content areas that you think may be challenging, explore them. If you have taken AMWA courses covering these content areas, use the exams to review the topic.”

—**Kim Rowe, MWC**



#AMWA2019

CONFERENCE PREVIEW

It's Going to Be Sunny in San Diego

R. Michelle Sauer, PhD, ELS, CRA / Chair, Annual Conference Program Committee

In November 2019, the annual Medical Writing & Communication Conference will be in sunny San Diego. This southern California town is best known for its incredible weather and beautiful surf. With moderate temperatures year-round and gorgeous beaches on the Pacific coast, who would not want to come, network, and learn in this amazing location?

As the premier event in our field, the annual Medical Writing & Communication Conference focuses on trends and opportunities in medical communications. There has been a significant uptick in requests for guidance and discussions regarding how we can improve our professional lives outside of traditional education. Based on last year's attendee response to sessions that focused on self-care, the concepts of wellness and work/life balance were introduced as key topics in the 2019 Call for Proposals. Proposals for sessions on mindfulness, organization, exercise, health, and fun poured in, and the planning committee was overwhelmed by the sheer number and quality of proposals that were received. So, in addition to the traditionally strong educational, leadership, and technical program, look for a new "wave of information" on wellness and work/life balance.

AMWA is dedicated to supporting the "whole" member—and that means going beyond regular programming. In addition to the new sessions just described, the schedule will include morning walk and run groups to get your day started out right, and we will once again host a yoga session! San Diego will be the perfect city to serve as a host and backdrop to a conference that is sure to reinvigorate attendees in both professional and personal ways.

As always, the conference program will speak to the whole AMWA community and bring a new depth and energy to

the takeaways attendees will receive in support of their work as medical communicators. We are excited to present a new format of talks this year—**Med Write Talks**. Similar to the popular TED talks, these short 10- to 15-minute presentations will be dynamic, inspiring, and thought provoking. The committee had to make some hard decisions, but 6 proposals emerged from the rest and were chosen because of their engaging and unique messages. Each one will talk on a different element that is "universal." We hope you make time during the conference to attend the inaugural Med Write Talks, as they are sure to deeply inspire listeners and focus on discrete, medical communication-related topics with a novel insight or angle. This highly selective opportunity is sure to bring a new energy to the conference.

During the breaks and evenings, be sure to enjoy the sights, sounds, and food of San Diego. The host hotel (Sheraton San Diego Hotel & Marina) is strategically located on the waterfront, so you can go for a sail, walk on the beach, or enjoy any one of the many gourmet restaurants in the area. You can rent a bike (or a jet ski) and enjoy the gorgeous weather that is sure to come once you arrive.

Come early or stay late and you can also enjoy some of the major attractions in the area including the world-renowned San Diego Zoo, Sea World, and Legoland. Overall, this year's conference will encourage you to walk in the sun—literally and metaphorically. We hope you will walk away with a more "sunny" disposition and new, positive relationships and ideas will take root.

Register now and plan to join us November 6-9. Prepare your professional and personal self for an experience that only AMWA can deliver.

Daniel J. Siegel, MD, 2019 Alvarez Award Recipient

R. Michelle Sauer, PhD, ELS, CRA / Chair, Annual Conference Program Committee

The **Walter C. Alvarez Award** is named in honor of Walter C. Alvarez, MD, a pioneer in the field of medical communication. The award is presented to either a member or nonmember of AMWA to honor excellence in communicating health care developments and concepts to the public. The Alvarez Award is presented during AMWA's Medical Writing & Communication Conference.

This year, **Dr Dan Siegel** will be honored for his latest contribution, *Aware: The Science and Practice of Presence*. This book builds on Dr Siegel's long-standing career in psychotherapy, which has produced more than 20 books and textbooks in addition to journal articles, presentations, and protocols. After graduating from Harvard Medical School,



he completed his postgraduate education at the University of California, Los Angeles (UCLA), where he is now a Clinical Professor of Psychiatry in the UCLA School of Medicine. Dr Siegel has dedicated his career to promoting insight, compassion, and empathy in individuals, families, institutions, and communities. Dr Siegel is also the Founder and Co-Director of the Mindful Awareness Research Center at UCLA, a Distinguished Fellow of the American Psychiatric Association, and the Executive Director of the Mindsight Institute.

His most recent work, *Aware*, starts with a practical guide to readers on how to understand and use the “wheel of awareness” to promote focus and calm in our everyday lives. As he guides his reader through practical meditation exercises, he repeats the phrase “ride the wave.” What an excellent catchphrase that matches our conference location for 2019! For meditation skeptics, this book details how focusing our attention enables an increase in neural firing. Dr Siegel's theory (and catchphrase) is “Where attention goes, neural firing flows and neural connection grows.” The second half of the book details the scientific basis of the practices. As readers learn to better understand how the “wheel” works, they are able to utilize the tool and use it to literally reprogram their brains to reduce stress and increase peace. This work is more than a book—it is a hands-on guide that is sure to make an impact in many lives.

Dr Siegel's ability to clearly communicate complex and abstract theories to a lay audience is only matched by his dedication to underscore all advice with scientific evidence. A reader (or listener) gains a sense of empowerment with each page. This is demonstrated by his long list of best sell-

ers. You may also know him from a previous book, *Mindsight*, which was published in 2010 and describes to readers how to use their “mindsight” to heal from trauma and embrace a higher emotional and social intelligence. He has also focused several books on parenting and child development. His best seller *Brainstorm* describes how brain development affects the behavior and choices of today's teenager and gives practical tips on how to navigate interactions with this age group. For each of his several books, his audience and his topical focus vary, from the general public to the professional, and from child development to meditation. Yet the individual works all focus on how people can make positive changes in their lives.

We are honored to host Dr Siegel this year and look forward to his address. If you are a fan of his work, or if you are interested in interpersonal neurobiology, be sure to be at his address. Have questions or want to delve into one of his books? Be sure to stick around after the presentation, when Dr Siegel will answer your queries and sign your book.

Daniel J. Siegel, MD, is a graduate of Harvard Medical School and completed his postgraduate medical education at UCLA with training in pediatrics and child, adolescent, and adult psychiatry. He is currently a Clinical Professor of Psychiatry at the UCLA School of Medicine, founding Co-Director of UCLA's Mindful Awareness Research Center, founding Co-Investigator at the UCLA Center for Culture, Brain and Development, and Executive Director of the Mindsight Institute, an educational center devoted to promoting insight, compassion, and empathy in individuals, families, institutions, and communities.

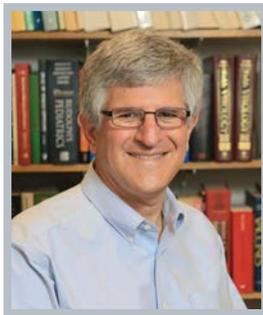
Dr Siegel's psychotherapy practice spans 30 years, and he has published extensively for the professional audience. He serves as the Founding Editor for the Norton Professional Series on Interpersonal Neurobiology, which includes more than 70 textbooks. Dr Siegel's books include his 5 *New York Times* best sellers: *Aware: The Science and Practice of Presence*; *Brainstorm: The Power and Purpose of the Teenage Brain*; *Mind: A Journey to the Heart of Being Human*; and (with Tina Payne Bryson, PhD) *The Whole-Brain Child* and *No-Drama Discipline*. His other books include *The Developing Mind (2nd Ed.)*; *The Pocket Guide to Interpersonal Neurobiology*; *Mindsight*; *The Mindful Brain*; *The Mindful Therapist*; *Parenting From the Inside Out* (with Mary Hartzell, MEd); and *The Yes Brain* (also with Dr Bryson). He has been invited to lecture for the King of Thailand, Pope John Paul II, His Holiness the Dalai Lama, Google University, and TEDx. For more information about his educational programs and resources, please visit: www.DrDanSiegel.com and www.mindsightinstitute.com.

A Conversation with Paul Offit, MD, 2019 McGovern Award Recipient

Cynthia L. Kryder, MS / 2018–2019 AMWA President

*The **John P. McGovern Award** is named in honor of John P. McGovern and is presented to a member or nonmember of AMWA to recognize a preeminent contribution to any of the various modes of medical communication. The McGovern Award is presented during AMWA's Medical Writing & Communication Conference.*

I'm thrilled to announce that our 2019 McGovern Award recipient is **Paul A. Offit, MD**. Dr Offit is a pediatrician specializing in infectious diseases and an expert on vaccines, immunology, and virology. He is the Director of the Vaccine Education Center at the Children's Hospital of Philadelphia (CHOP) as well as the Maurice R. Hilleman Professor of Vaccinology and a Professor of Pediatrics at the Perelman School of Medicine at the University of Pennsylvania.



Dr Offit is a recipient of many awards including the J. Edmund Bradley Prize for Excellence in Pediatrics from the University of Maryland Medical School, the Young Investigator Award in Vaccine Development from the Infectious Disease Society of America, and a Research Career Development Award from the National Institutes of Health. He has published more than 160 papers in medical and scientific journals in the areas of rotavirus-specific immune responses and vaccine safety. He is also the co-inventor of the rotavirus vaccine, RotaTeq, recommended for universal use in infants by the Centers for Disease Control and Prevention (CDC). For this achievement Dr Offit received the Luigi Mastroianni and William Osler awards from the University of Pennsylvania School of Medicine and the Charles Mérieux Award from the National Foundation for Infectious Diseases and was honored by Bill and Melinda Gates during the launch of their Foundation's Living Proof Project for global health.

In addition to his day job, Dr Offit has found the time to write 8 medical narratives. (He tells me he writes during the early morning hours.) His book *Vaccinated: One Man's Quest*

to Defeat the World's Deadliest Diseases (HarperCollins, 2007) earned an AMWA Medical Book Award in 2007. His latest book is *Bad Advice: Or Why Celebrities, Politicians, and Activists Aren't Your Best Source of Health Information* (Columbia University Press, June 2018). These and other books, videos, op-ed pieces, and interviews may be found on his website: <http://paul-offit.com/>.

I had the opportunity to talk with Dr Offit recently about a range of topics. Here is a summary of our conversation.

CK: You began your career as an intern and resident at Children's Hospital in Pittsburgh. What in particular fueled your interest in infectious diseases and led to your subsequent fellowship in infectious diseases at CHOP?

PO: It was the usual arbitrary event. I was fortunate to work with Ellen Wald, an expert in pediatric infectious diseases, at Pittsburgh and she ignited my interest in infectious diseases.

CK: *The Cutter Incident: How America's First Polio Vaccine Led to Today's Growing Vaccine Crisis* (Yale University Press, 2005) was your first narrative nonfiction book. Tell me about the Cutter incident and what inspired you to write about it.

PO: The Cutter incident was responsible for the birth of vaccine regulation in the United States. When Jonas Salk developed the polio vaccine in 1955 it was an historic moment. We could finally protect people from this devastating disease.

Interestingly, it took the government 2 hours to license Salk's vaccine. At the time, some officials

“Medical communicators are . . . at the forefront in the battle against scientific denialism.”

thought that was too long! Five companies manufactured the polio vaccine. Cutter Laboratories, a small pharmaceutical company in Berkeley, California, happened to do it poorly.

Recall that Salk's vaccine was developed by inactivating the live poliovirus. As discovered later, during its manufacturing process, Cutter failed to follow Salk's protocol to kill the virus. Consequently, 200,000 people were inadvertently inoculated with live virulent poliovirus: 70,000 became ill, 200 were permanently paralyzed, and 10 died. As a virologist, I wanted to understand how this problem went undetected by the company and federal inspectors. My favorite chapter in the book is “Chapter 6: What Went Wrong at Cutter Laboratories.”

CK: What are the biggest changes you've seen in your more than 40 years as a physician with regard to the public's understanding—and acceptance—of proven medical science?

PO: We are a more cynical and litigious society today. Forty years ago, we were more trusting. Today we are more apt to see evildoers or presume nefarious intent. The Cutter incident is a good example. Although Cutter was found liable to pay compensation to those damaged by its polio vaccine, it was not found to be negligent in its production. In exit interviews, Cutter incident jurors were sympathetic; they did not want to find Cutter guilty. The jurors recognized that we didn't have the technology at the time to make a safe vaccine and they understood that medicine is always a process of evolution. I doubt that would be the case today.

As a society, we've moved from scientific literacy to scientific denialism that is being fueled to some extent by social media, which allows opinions not supported by evidence to spread rapidly. Anyone can make whatever unsupported claims they want on social media without being held accountable. I believe that people don't like the fluidity of science and they don't respect that science constantly evolves. As a result, they are drawn to gurus who have a guise of authority and who don't express doubt in the claims they make, even when evidence is lacking.

CK: Medical communicators evaluate information in the context of potential bias stemming from the commercial purpose of the content. Can you share any tips about how to critically evaluate content to determine if it's from a legitimate source?

PO: It's difficult with online content. You often can't sufficiently determine a site's legitimacy unless you're an investigative journalist. I recommend that you follow the money. Do some digging to determine who funds the site. Look at the advertisements on the site. And if the content comes from an organization such as a nonprofit, look at the people who sit on its board of directors.

With regard to scientific data from peer-reviewed sources, most of us have a certain level of trust that the data are correct and the sources are trustworthy. In my opinion, though, peer review is weak. Reproducibility is the strongest pillar. If data haven't been reproduced, we should view them with caution. If you're unsure, at the very least seek out an expert in the field and trust what they tell you.

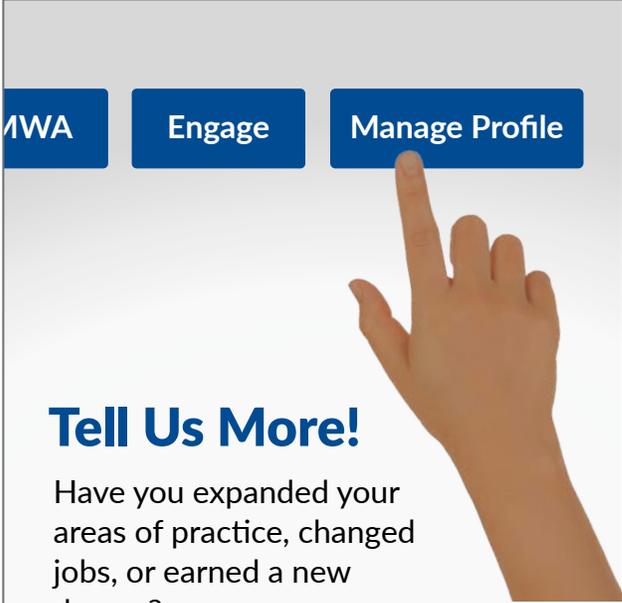
CK: AMWA supports evidence- and science-based medicine and the use of objectivity and diligent research in pursuit of accurate and unbiased reporting. Given the proliferation of scientific inaccuracies, what advice can you give to medical communicators to ensure that we don't become part of the problem?

PO: Medical communicators are doing their jobs at a time when science is under siege. You are at the forefront in the battle against scientific denialism. Never before has it been as important as it is now to translate science accurately and understandably. My advice is to stay humble. Recognize that you aren't an expert on every topic you write about. Know what you don't know.

CK: Tell me about your next book.

PO: I'm working on a book about overkill, when modern medicine goes too far. I'm throwing around a couple of titles at the moment. Perhaps AMWA members can help me settle on one. Let's talk in San Diego.

Dr Offit will receive his award and deliver his presentation on Thursday, November 7, 2019, during AMWA's Medical Writing & Communication Conference in San Diego, CA.



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FEATURE-LENGTH ARTICLES

Feature-length articles include Topical Features, Original Research, and Science Series articles. Authors should submit an abstract of 250-300 words for use in the online Table of Contents and in social media/marketing; visual abstracts are welcome.

Topical Features

The *AMWA Journal* invites manuscripts on areas of interest to medical communicators, including topics within such broad categories as regulatory writing, continuing medical education, patient education, medical marketing/advertising, public relations, medical journal management, publication ethics, health policy, etc. The *AMWA Journal* especially encourages the submission of articles on the theoretical underpinnings of specific types of medical communication. *AMWA Journal* readers are primarily practitioners (not academicians), and application of theory to practice is an essential component of manuscripts. **Word Count:** 2,500-3,000 words (plus abstract).

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The *AMWA Journal* invites manuscripts reporting original research on written communication, publication trends, and medical communicators' productivity and value added. **Word Count:** 2,500-3,000 words (plus abstract).

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The Science Series accepts manuscripts that provide an overview of a specific anatomic or physiologic topic (eg, body system), disease or condition, diagnostic method (eg, laboratory tests, imaging systems), or type of treatment (eg, devices). **Word Count:** 2,500-3,000 words (plus abstract).

OTHER TYPES OF ARTICLES

Authors should submit 1 or 2 sentences (15 to 30 words) describing their article for use in the online Table of Contents and in social media/marketing.

Around the Career Block

The Around the Career Block section accepts manuscripts that provide advice on career-related issues, profiles of professional organizations, and first-person accounts of educational experiences. **Word Count:** 750-2,000 words.

Career-Related Articles

These articles address topics relevant to the career development of medical communicators. Areas of interest include job hunting, developing a portfolio, interviewing techniques, hiring guidance, performance evaluation, mentoring programs, and performance goals.

Profiles of Professional Organizations

These profiles help readers discover or better understand organizations that address specialty niches and may therefore be a useful supplement to AMWA membership.

First-Person Accounts of Educational Programs

These articles provide overviews of educational programs designed to enhance the knowledge and skills of medical writers and editors.

Media Reviews

The Media Reviews section includes reviews of books, websites, and other media that are of practical value or topical interest for medical writers and editors. **Word Count:** 500-600 words.

Practical Matters

The Practical Matters section accepts manuscripts that provide practical guidance to medical writers and editors (at all levels of experience) for improving the skills involved in their daily work activities in a variety of medical communication settings. **Word Count:** 750-2,000 words.

Regulatory Insights

This section provides information of particular interest to communicators who write or edit documents related to the pharmaceutical or device industries. **Word Count:** 750-2,000 words.

Social Media

The Social Media section includes articles focusing on the use of social media and networking in the medical communication industry. **Word Count:** 750-2,000 words.

Tech Talk

The Tech Talk section includes articles about technology topics that may be of interest to biomedical communicators. **Word Count:** 500-1,000 words.

Statistically Speaking

This section covers statistical concepts and developments in clinical research of interest

to medical communicators. **Word Count:** 750-2,000 words.

Everyday Ethics

The Everyday Ethics section features discussion of ethical situations encountered by medical communicators and professional approaches to their management. Publication preference is given to those topics that are particularly timely. **Word Count:** 750-2,000 words.

Members Matters

Members Matters is a member-focused, member-generated section, where topics of interest that were discussed on the local level can be shared nationally through the *Journal*. Content may be original (ie, written specifically for the section) or shared (eg, repurposed from an article in a chapter newsletter). **Word Count:** 750-2,000 words for a feature article; 500-600 words for a brief report.

OTHER SECTIONS

Sounding Board

The Sounding Board is a forum for members' opinions on topics relevant to medical writing and editing. Contact the *Journal* Editor to seek approval for the topic before preparing and submitting a manuscript. **Word Count:** 750-1,000 words.

Letters to the Editor

Letters to the Editor provide an opportunity to comment on topics published in the *Journal*. Letters should refer to content within the past 2 issues. **Word Count:** 300-400 words.

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Manuscripts are accepted for consideration with the understanding that they have not been published elsewhere and are not under review elsewhere. Submit the manuscript as an attachment to an email note to the *Journal* Editor (JournalEditor@amwa.org).

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Walter C. Alvarez Award: Robert M. Califf, MD, MACC

The Walter C. Alvarez Award is named in honor of Walter C. Alvarez, MD, a pioneer in the field of medical communication. The award is presented to either a member or nonmember of AMWA to honor excellence in communicating health care developments and concepts to the public. The Alvarez Award is presented during AMWA's Medical Writing & Communication Conference.



Thanks for that great introduction. It's nice to be introduced by someone with common roots with the Blue Devils! So, first of all, I do want to thank you for the honor of getting this award. It's nice to be recognized for communications. My wife is in the back somewhere. She was threatening to protest the idea that I would be considered a good communicator—that's not necessarily been the case at home.

In thinking about my topic for today, I knew I was going to be dealing with a preeminent organization of communicators. I thought I would pick a couple of tough problems for you to consider—issues that we're encountering now that will require the best communication skills if we're going to work our way through them.

The first issue is the trajectory of health outcomes in the United States. I call this the despair part of the talk. And I've actually been surprised, as I've been talking about this around the US, by how few people are aware of the decline in our health statistics and associated factors.

The second issue is exciting, but also something that we're all going to have to work on to understand: the "fourth industrial revolution." What does it mean when the whole world becomes digitized? This fundamental change forms the basis for my work at Alphabet and at Duke—amazing opportunities but also risks.

And the third issue is something that is absolutely critical to our day-to-day life. We all need to be paying attention to the issue of misinformation on the internet and in social media.

The Direction of Health Outcomes in the United States

So, here's the despair part of the talk. This is a map of life expectancy in the United States by county (Figure 1A). It's the work of the Global Burden of Disease group at the Gates Foundation. As many of you probably know, this group is well known for helping low-income countries develop their health systems by putting together all the available epidemiologic data and creating projections and maps to show the state of health with analysis of trends to point to valuable future policies.

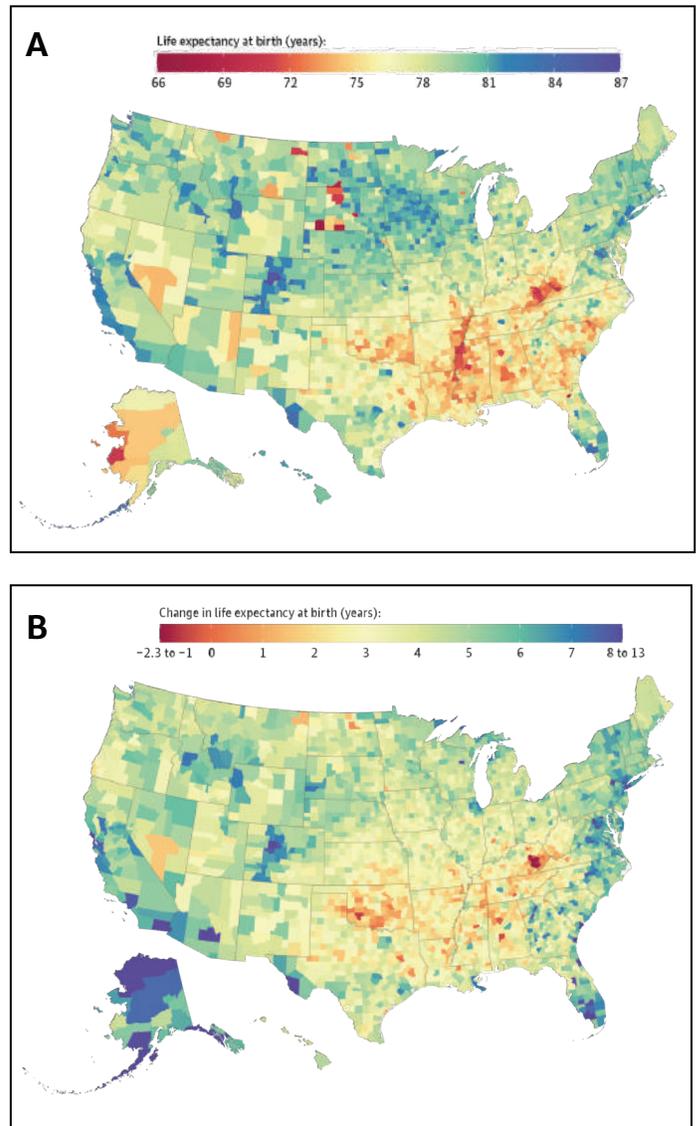


Figure 1. (A) Life expectancy at birth by county, 2014. (B) Change in US life expectancy at birth by county, 1980 to 2014.

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But they've recently provided major insight into the US because we look like a developing country in reverse at this point. And the pattern that you see here you'll notice is eerily similar to the voting map. Red means shorter life expectancy. Blue means longer life expectancy. And there is a very highly significant correlation between life expectancy by county and voting patterns in those counties.

Just a few other anecdotes to think about this that relate to this general issue. In one of the most interesting big data studies, some researchers looked at all the sources of big data they could find to predict the voting patterns by precincts in the United States (published by Timnit Gebru, et al. in Proceedings of the National Academy of Sciences; doi: 10.1073/pnas.1700035114). The best predictor they found was the ratio of pickup trucks to sedans (Figure 2). The vehicles that just happened to be in those pictures of your house on Google Street View that have all the vehicles are highly predictive of the voting pattern.

If you look at these same maps in regard to search patterns, you find that different search patterns are evident. The blue counties tend to search on 401K retirement accounts, gifts for relatives, and exercise equipment and outfits. The red counties tend to search on guns, pickup trucks, religious rapture, and conspiracy theories, especially about minorities.

And what really should be getting people's attention is not just that we have differences in health outcomes but that the differences are widening considerably over time. Figure 1B shows the trajectory of life expectancy, where blue means getting better over time and red means getting worse. And you'll notice the places that were already experiencing a shorter life expectancy are headed in the wrong direction. The places that had a longer life expectancy historically are getting better. Obviously, these are trends that don't apply to everything and everybody, but they're highly statistically and clinically significant.

Most of you are fully aware that for over 100 years schools of public health have chided schools of medicine because doctors are taught that biology is the basis of health and disease. The schools of public health have known for 100 years that social factors are the major determinants of health. If you know zip code, family wealth, education, sex, and race, you have the majority of the predictive capacity for life expectancy in the United States. And the data are getting better and better.

Now that we have so much better data, is it worth examining how these social determinants manifest? How is it that they lead to bad health outcomes? Not so surprisingly now that we have the data geospatially mapped, it turns out that these differences are mitigated by biological risk factors that we understand—lipid levels, exercise levels, smoking levels, obesity, glucose levels, and frank diabetes. So, biological factors that we understand are playing out due to these social determinants.

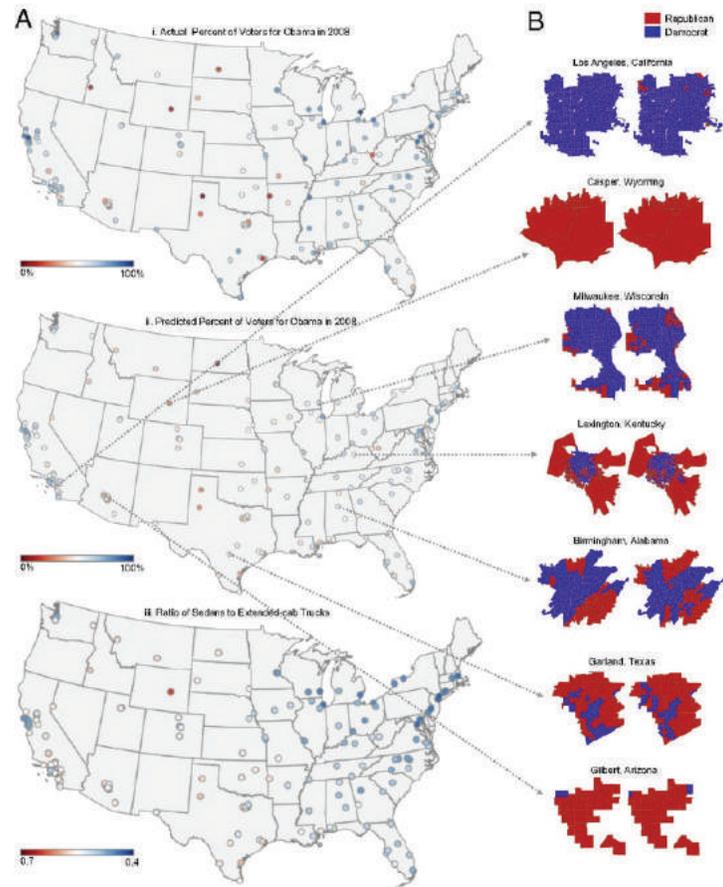


Figure 2. Actual and inferred voting patterns. (A) i and ii map the actual and predicted percentage of people who voted for Barack Obama in the 2008 presidential election ($r = 0.74$). iii maps the ratio of detected pickup trucks to sedans in the 165 cities in our test set. As can be seen from the map, the ratio is very low in Democratic cities such as those in the East Coast and high in Republican cities such as those in Texas and Wyoming. (B) Shows actual versus predicted voter affiliations for various cities in our test set at the precinct level using our full model. Democratic precincts are shown in blue, and Republican precincts are shown in red. Our model correctly classifies Casper, WY, as a Republican city and Los Angeles, CA, as a Democratic city. We accurately predict that Milwaukee, WI, is a Democratic city except for a few Republican precincts in the southern, western, and northeastern borders of the city. Reprinted from Gebru T, Krause J, Wang Y, et al. Using deep learning and Google Street View to estimate the demographic makeup of neighborhoods across the United States. *Proc Natl Acad Sci.* 2017;114 (50):13108–13113; doi: 10.1073/pnas.1700035114.

The net effect is that we're about to have our third straight year in the United States of a reversal in life expectancy. I never thought I would see this in my lifetime—surprising and shocking. And of course, the added factor that's really changing things more quickly than the general metabolic trends are opioid overdose and suicide, so-called “diseases of despair.”

Suicide rates are going up. It's still a little unclear how much of the increased suicide rate is due to the proliferation of guns because most suicide attempts are unsuccessful. It turns out it's hard to kill yourself by hanging or cutting yourself. But if

you've got a gun, pulling the trigger is a simpler, more effective method for suicide. So, the proliferation of guns in the United States has the biggest effect on suicide, not on homicide.

And then, if you're not already depressed enough, how do we wake people up without being unnecessarily divisive or negative? I think the underlying question here as communicators is how do you deal with a population that tends to think it has the best health and health care in the world, but then you look at the data and it's not that way; in fact is heading in the wrong direction?

And so, these increasing causes of death have been termed by some prescient economists as "deaths of despair." When we look at other economically advanced countries shown on Figure 3, you'll see that the trend is that these deaths have declined and then leveled off at this point. But white people in the United States between ages 50 and 54 have a dramatic escalation of death rates—deaths of despair; and the trend is distinctly different from other high-income countries in a negative direction.

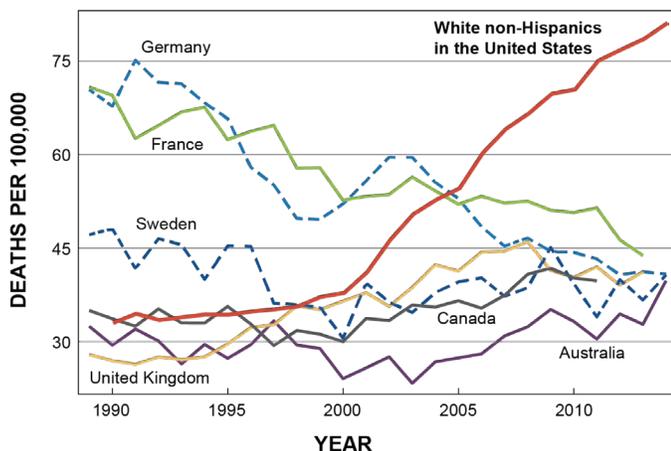


Figure 3. Midlife mortality from “deaths of despair” across countries. Men and women ages 50–54 years, deaths by drugs, alcohol, and suicide, 1989–2014. *Reproduced with permission from Case A and Deaton A. Mortality and morbidity in the 21st century. Brookings Papers on Economic Activity, Spring 2017.*

This is really meaningful to me because I've written and lectured on disparities. For the first time, over this last year, I can talk about the fact that people like me are experiencing a dramatic trend toward poor health outcomes. We used to be the reference group—white men were doing well. And then disparities were characterized by measuring health outcomes in other people in relation to “us” in terms of health outcomes, but this is the fastest changing part of the US population. Specifically, white men who live between Oklahoma and West Virginia have the fastest deterioration in outcomes across the US. That whole strip of the US was bright red on the slide that

I showed, and it is experiencing a dramatic increase in mortality rates.

Our discussion so far should be reason for concern for all Americans, but we're not finished with all the despair yet. This just came out last month in the *British Medical Journal* (<https://www.bmj.com/content/362/bmj.k2562>). (I think all the American journals were afraid to publish it.) Figure 4 shows the 18 highest-income countries in the world with their life expectancy. The trends are most dramatic recently. But you'll notice that, if this were a sports league, every other team in the league is getting better except for one. That's the United States. And what's particularly striking about this, being a sports person, is that I'm sure you know that if you're looking to become a manager of a team, you'd like to take over the last place team as manager. Even if you're no good, by regression to the mean, the last place team tends to look better over time. But we're defying that rule because the United States is not only in last place, but it is dropping relative to the other 17 high-income countries. And in projections from the Global Burden of Disease group ([https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(18\)31694-5/fulltext#secsectitle230](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)31694-5/fulltext#secsectitle230)), by 2040 the United States is projected to be 64th in the world in terms of life expectancy. In 2016 we were ranked 43rd in the world.

So, we have some serious issues, and I hope you will be communicating more about this, although I'm not sure exactly what form of communication would lead to effective intervention.

And then the last part of the despair slides is if you were selling a product called “health care” and you were in last place and you were charging twice as much as anybody else, then it would not be a product that most people would want to buy. So that's the last really depressing slide—the US is not only in last place in health outcomes among high-income countries, it also spends much more.

When people say, okay what's different between us and the other 17 high-income countries to which we're compared? Two big differences—one is their policies are all based on the concept that health care is a *right* in their countries, not a privilege. And secondly, they all have comprehensive, highly functional primary care systems.

We've chosen to spend our money on sophisticated but expensive technology. Other countries spend a much higher proportion of their health care dollar on primary care. Also, if you compare the United States versus the other 17 high-income countries, if you look at technical health care plus social services, we're all spending a similar proportion of our gross domestic product. However, the other countries spend a much higher proportion, in particular, on social services than we do. And the result is better health outcomes for their populations.

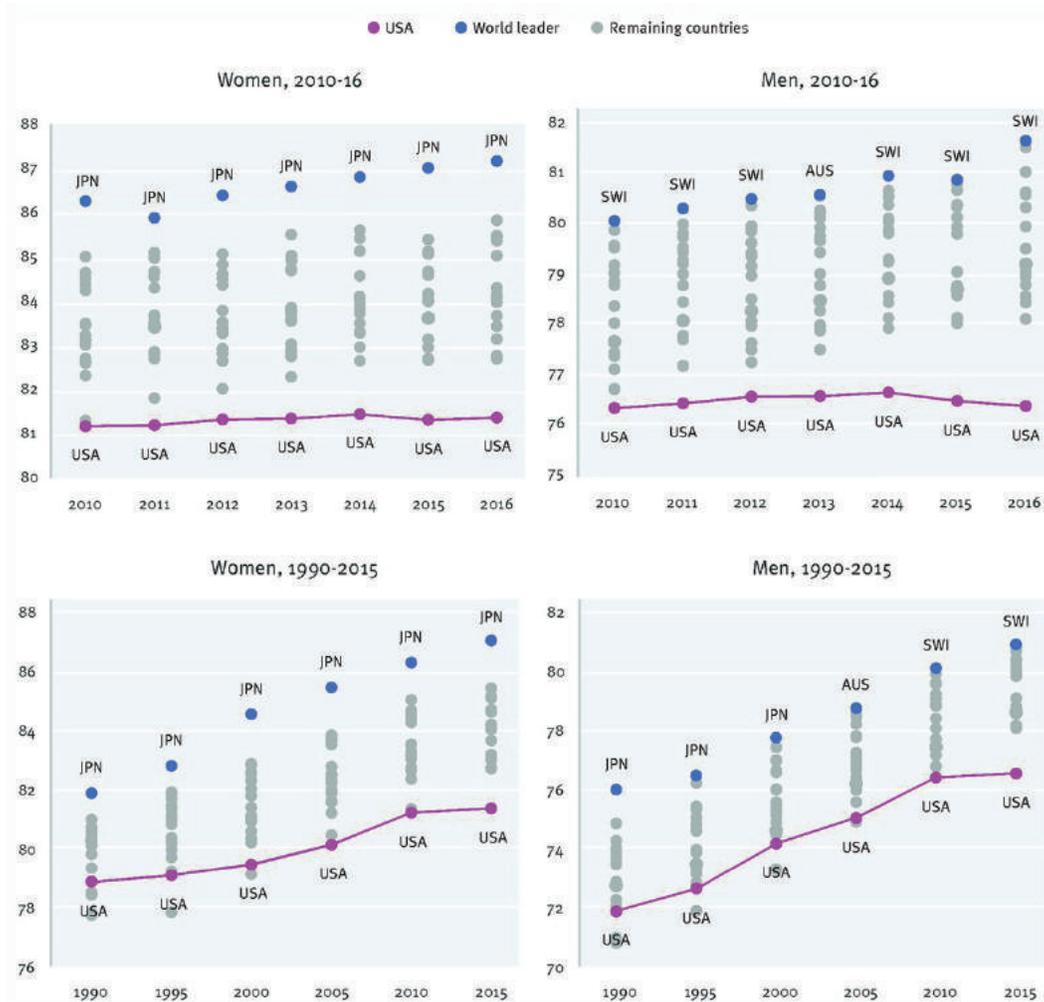


Figure 4. Life expectancy at birth (years) in 18 high income countries for women and men during 2010–16 and 1990–2015. Data for Canada are not available in 2016. AUS=Australia; JPN=Japan; SWI=Switzerland; USA=United States. *Reproduced from BMJ, Ho JY, Hendi AS, 362, k2562, 2018 with permission from BMJ Publishing Groups Ltd.*

Churchill said that Americans always do the right thing after they’ve exhausted all other possibilities. And so, I have absolutely no hope that America will develop a highly effective primary care system any time soon. It’s actually not even physically possible to do, because if you had to start now to train all the primary care people that you would need and to deploy them, it would take too long. Given the impending person-power shortage, I’m enthusiastic that technology assistance and enablement is going to be a very important way to work our way out of this situation that we’re in. The good news there is that this is part of the high technology that America leads in that will help even the countries that are doing better than we are with regard to general health because they’re going to face many of the same issues that we currently face. Because the epidemic of infectious diseases in low-income countries is better controlled, chronic noncommunicable disease becomes critical.

The Fourth Industrial Revolution

When I describe my view of this construct, I think it’s useful to think of yourselves sitting here as if you’re in society back in the days when there was no external source of power and all manufacturing had to be done by human labor. And then the first industrial revolution was steam power. You can imagine how different things were when you went from having no external source of power to having steam power. The world changed. People’s jobs changed. The ability to make things changed. And just as people got adjusted to that, along came electricity. Dramatic changes happened when electricity came in. There are great books written about London and how many people lost their jobs but also about how many people gained new jobs as mass production now became possible. Somebody had to put down the power lines and make the electricity available to the whole population.

The third industrial revolution is one that I think we're still sort of recovering from, and that's information technology and computing in general. I can see a lot of you in the audience, like me, were around before email was available. And the reason I say we're still adjusting is I certainly haven't figured out what to do with email; I'm still overwhelmed by it. So, the third industrial revolution is still having a big impact. But obviously, a lot of things have changed because of the widespread availability of computing.

So, what is the fourth industrial revolution? It's happening very rapidly because almost all scientific information is becoming digital. I think an easy way to think about this is the human genome. Not too long ago it was a construct. We didn't know what it was. Then, thanks to teams assembled by Francis Collins and Craig Ventner, we ended up deciphering the genome. But really the manifestation of the genome that we deal with now is just a bunch of digits. And those digits—3.2 billion base pairs stored in a computer—can now be interfaced with other phenomena stored in computers to begin to see what the genetic code actually produces and how it interacts with biological systems to produce proteins that determine our biology. But now, all the biological and physical sciences are essentially becoming an information science, leading to vast changes in the way that we can think about data and information and in the ubiquity of digital effects.

The depiction of the blind men and the elephant captures my experience with medical research up until now. As FDA commissioner and before that with the clinical trials I led or in which I participated, the majority of trials did not match the expectations of the sponsor or investigators. In fact, most of the clinical trials I've led were phase 3 and beyond. Accordingly, I would always be dealing with people who had their very best scientific ideas, years of preclinical work convincing investors that it's worth putting millions of dollars into this, working on animal models, then getting an IRB to say that it's okay to do this to human beings, and then even getting through phase 1 and phase 2. And even after all of this work and culling out the drugs that were toxic or ineffective, when you get to phase 3, there's still about a 60% failure rate. So, why do people's very best ideas not make it? Almost always in retrospect it was because of integrative biology involving mechanisms and complex systems biology that you couldn't have anticipated with what you're able to measure. So, in my view, it's fundamentally a computational limitation—that is, you had to study what you could *measure and compute*. Because you couldn't store the data (it was so expensive, even if you could measure it), there was no way to look at how all the different parts of the elephant fit together to visualize the whole elephant. And so, we've been like the blind men and the elephant. But now, computation is no longer a limitation to seeing the

whole elephant. It's still fuzzy, but we can see the whole elephant. And in fact, we can see the whole herd of elephants and the environment in which they're operating. Except, of course, our purpose is not elephants; it's people that we're interested in.

The physical manifestation of this for me now is what's called the Baseline study. And I want to acknowledge again that I'm totally conflicted here because I work for Verily Life Sciences—the sponsor of the study—and I'm a faculty member at both institutions that are enrolling volunteers into the study—Duke and Stanford.

One way to explain the concept to people is my first day at Alphabet, when the Waymo team gave a presentation. Waymo is Alphabet's autonomous vehicle company. It's now on the roads in several American cities. But my very first day, the Waymo people gave a presentation with driverless cars—they had hired dozens of bicyclists and told them just to pedal around and do crazy stunts all together, and the question was: could the car navigate 68 bicyclists in random motion. Now to do that it has to calculate the trajectory of each of the 68 bicycles 3 times a second and project where each was going to go in the next third of a second to figure out how to weave through this maze. And it did it! But what really stuck with me in the presentation is that they said we can only do what we do with Waymo and maps because every road in the United States has been mapped and kept up to date.

So, here's a way to think about the change that may occur now with human health. Ten years ago, if you had picked up your shiny new Apple phone—that was about when Apple phones came out, the iPhone—if I'd walked up to you and said, "You know that phone that you think is so great? Just wait a couple of years, it's going to be part of your car. You'll just get into your car and start talking to your car and tell it where you want to go. And your car is going to talk back to you. It will look at all the roads between where you are and where you want to go. And it will change what it tells you in real time based on what's being reported from all of those roads." Ten years ago, you probably would have thought I was psychotic.

But now if I said, "Let's get in the car, and if we start to feel lost, we'll pull over to the side of the road, we'll open the glove compartment, we'll pull out a map, we'll unfold it, we'll try to figure out where we are, we'll try to draw the roads that we need to get on and we'll have no idea what's happening on those roads ahead of us." You'd probably say that that would be really stupid; who would do that when you can just talk to your car, and it can tell you where to go?

But in health care now and biomedical research, we don't have a basic map. We have had difficulty even conceiving of such a construct because it's so multidimensional and complex. Instead, we've focused on reductionist "slices" of the elephant and we haven't really mapped out the whole elephant.

This is the purpose of the Baseline study. We're engaging a group of volunteers and with their permission and agreement we're trying to measure everything we possibly can about them. Just the biomedical measurements in the first 2 days would involve 6 terabytes of data if we ran all the tests on all the samples collected.

In addition to the sheer volume and breadth of data, an important point is that we've been totally hamstrung by the dimension of time. As you know, when you do biomedical research now or when you go to see your doctor, for the most part, it's an episodic, periodic visit. And everyone's trying to extrapolate what happened between point A and point B in time because there was no way to measure it. For example, many of us have been to see the Rolling Stones for decades in a row, but you only see one concert every decade. Obviously, Mick Jagger's face has changed a bit over 4 decades. But you can imagine that if you really wanted to understand the biological change of Mick Jagger, it would be much better to be able to measure this continuously.

Now, due to the dramatic changes in sensors and computing, there is no physical limitation to streaming data to the cloud and evaluating parameters continuously over time. Many technical issues need to be worked out, but the fundamental limitation we had of not being able to stream and store the information is no longer a limitation as we try to understand the human condition.

In addition to the biology element and the time element, we also now have health systems. Health systems are collecting and storing your health encounter information every time you touch the system by going to a clinic or hospital or by having a virtual encounter such as getting prescriptions refilled, and they're putting that information into data warehouses right now (mostly for business), but hopefully, in the near future, to better understand how to provide better care.

In that vein, just to give you an idea of where this is headed, we've been working in the People-Centered Research Foundation, which is funded by PCORI, an institution that you probably know about. The idea is if you put patient advocacy groups together with health systems and have them curate their information to make it transportable across systems in terms of analysis, you could end up with a research system that would include a large part of America that could do the research at a much lower cost because the data would be readily available, and the patients would be volunteering for the studies because they wanted answers to the questions that are not currently being answered. And this network now is curating data on a very large part of America across multiple health systems, now including more than 100 million people. A large proportion of you are in this network.

The beauty of the network right now—just with regard to the data—is that consent is not required because the data never leaves the system that you're already participating in. What happens is because a common data model is used, the question can be asked and the question is answered within each of the systems that you already use to get your health care, so that there is no risk of inappropriate use of data beyond your own health care system. This approach enables the answers to be aggregated on this large scale. The next phase is going to be to integrate better with the patient advocacy groups and clinicians so that we can get prospective studies done at a much quicker rate, but I wanted to give you a sense of the scale that's now developing with regard to data.

And then we have the great frontier—digital phenotyping—which has been the most fun for me because this frontier didn't exist until very recently. Using digital information across all these dimensions of biology, clinical care, behavior, and social interaction will lead to a major reclassification of disease.

I won't ask for a show of hands of who has trouble sleeping, but I'll bet there are a lot of you who do. We're seeing it in the Baseline study. But just think about the way sleep has been dealt with medically up until now. You have to come in and complain. Most doctors don't ask a lot about how you're sleeping. And then your doctor doesn't really know what to do most of the time if there is an identifiable problem because not a lot is known about sleep. The drugs we have are rudimentary and they have a lot of side effects. And if it's really troublesome, you get sent to a sleep center where you try to go to sleep in an environment that is nothing like what you would normally try to go to sleep in.

Everyone in the Baseline study goes home with a cell phone, a watch, and a sleep sensor. But I have to say, the sleep sensors are not where they need to be yet. There are all kinds of issues, like there are dogs and cats in the bed and other kind of things that you have to sort out in the engineering, analytics, and human factors. But I think much more useful information is imminent, and, in the next short period of time, we'll have very high sensitivity for measuring how well you're sleeping, really costing almost nothing because the sensors are incredibly cheap. And you and your doctor can think about whether interventions are needed. But it may be even more important when this can be measured routinely in everyday life on a large scale. I believe the entire biology and physiology of sleep is going to be reinvestigated and understood in a different way.

There's a great article about this by Tom Insel, the former head of the NIMH, on digital phenotyping (*JAMA*. 2017;318(13):1215-1216. doi:10.1001/jama.2017.11295). Basically, the idea here is just like we think about biomarkers and genetics, the way you behave as you interact with the digital environment creates a marker of who you are. A simple

way to think about this is that if you have a tremor and you're holding your cell phone, it's very easy to pick up that you have a tremor. If you're having cognitive dysfunction, the way you interact with the keyboard is obvious. A simple thing is if you're depressed, as you get more and more severely depressed, you don't even have to know what people are talking about. You're carrying a cell phone in your pocket or pocketbook and the radius of your activity diminishes as a function of how depressed you are.

As we're beginning to use big data analysis to understand this, much, much more can be understood that could be very helpful in health care. As I've already shown you on the first maps, all of this information can be geospatially placed, which is very important if we're going to intervene in these areas that have bad health outcomes. What I showed you by county, you can take to the level of the street or the neighborhood and see very big differences in health outcomes.

In data from the University of Pittsburgh's health system that we were looking at the day before yesterday, if you even look within a household—and this is not surprising, it's just that now it can be done—if you look at your health status and the prediction of your health risk as an individual and then you say: let's take all of the other people that live in the same house that you do, it has a major impact on the prediction that you would make about health outcomes. We share the same cultural habits. We may all be exposed to secondhand smoke. We're becoming aware of the microbiome that is commonly shared between our families and our pets with a big impact depending on how we hang out together.

And then finally, the most sensitive information. If you would be okay with my looking at every search you've ever done, raise your hand. There are some things I've searched on that I hope no one ever looks at, and we're all that way. So, this is very sensitive information. But more than 3 billion Google searches are done every day, and there are other search engines. So, essentially half the world's population is out there searching. And 1 out of every 20 is a health-related search. This information cannot be used without agreement, and integrating personal information into health care will require a substantial iterative effort to protect people's privacy and confidentiality in a way that they prefer.

As we think about the intersection of health and health care, we're just beginning to realize now that for every question a person has, an answer can be found on the Internet. This concept of "Dr. Google" drives doctors and nurses crazy. Over the last few years, there's been a massive effort to take the most common questions people have and to create what's called a "knowledge panel," which is curated, reliable information from respected medical sources. But this is really just a beginning. As professional communicators, you can imagine the issues

when you have more than 6 billion people in the world with thousands of languages (when you actually subfractionate the languages) and you've got to provide answers that are pertinent to all of those people at different levels of education and comprehension. This is a communications issue on a mega level! So, this is going to be a work in progress, but the early phases point to the importance of reliable, curated information about health and health care.

But beyond that, as you well know, there are at least 2 places where there's now societal agreement that the First Amendment does not pertain to the Internet. The first is terrorism. The second is suicide. A massive effort is in place to deal with these issues across social media platforms, including a combination of human effort and machine learning. It's imperfect, but the goal is to take down dangerous information in these domains as quickly as possible.

Then you get to the next level, which is searches about common chronic diseases. Suicide was chosen because it is such a major problem. Currently, if you're in the US and you're searching like you want to find a way to kill yourself, you get referred to the national suicide hotline. (Another thing to think about as a communicator is that every culture handles suicide differently, so an appropriate hotline message in the United States may be inappropriate in another culture, for example. So, there's a lot to think through about how to do that.)

But what if you're just depressed and you're not actively suicidal? It turns out that there are about 300 million people in the world who are depressed, and half of them never get treated for their depression. And even in America, it looks like it's about 7 years from the time someone is experiencing symptoms until the time someone actually gets treated for that depression. And treatment is not perfect, but it does have an effect. So, the question is, what can we do about this? Currently, if you're in the United States and you're searching on depression, a popup comes up that asks if would you like to take a questionnaire. The questionnaire is a medically validated questionnaire for depression—a PHQ-9—and if you score high on that, you get referred to the National Alliance on Mental Illness (NAMI), which is a patient advocacy group. But you could take any common disease, and it's pretty easy to see what people are searching on, often not telling their doctors, not telling their family members, etc. So, this as an area of communication, I would say, that is critical in the future.

Before I get to the last part of this presentation, I just want to mention a recent publication in *NPJ Digital Medicine* that exemplifies the good that can be done in an issue of concern to us all: food poisoning (<https://www.nature.com/articles/s41746-018-0045-1>). About 1 in 6 Americans gets food poisoning during a lifetime. And at best it's uncomfortable, but it can also lead to severe illness or death, an outcome that occurs

in about 3,000 people a year in the United States. As FDA commissioner, I was overwhelmed with the difficulty of trying to figure out which restaurant was the source of the food poisoning.

Well, you can bet when people have nausea and diarrhea, they're all over Google Search trying to figure out what's going on. So, as you might imagine, if you look through the searches and look for where the clusters are, you can figure out exactly which restaurant it was if you have the records of where those people shopped geospatially located (<https://www.nature.com/articles/s41746-018-0045-1>).

The little factoid that I thought was most fascinating—let's say you ate at restaurant X and then 12 hours later, you start throwing up. You feel like it's restaurant X, right? Well it turns out that 39% of the time, it was the restaurant you ate in *before* restaurant X that actually caused the food poisoning. So, some restaurateurs have been unfairly castigated for food poisoning that they didn't cause. On a serious note, the ability to rapidly identify the source of food poisoning is a major advance for public health.

Misinformation on the Internet and in Social Media

For this last part, I believe that your attention should be focused. It's now an established fact that untruthful statements reach more people faster and last longer on the Internet than truthful statements (Vosoughi S, et al. *Science*. 2018;359:1146-1151). And there are many possible reasons for this finding. The one that's appealing to me is that if you're telling the truth and it's a medical fact or science, you're obligated to also relay the uncertainty, the caveats, and the fact that the answer may change. If you're lying, you don't have to worry about those things—you can tell a very satisfying lie without any caveats because you're not constrained by having to relay the uncertainty.

And let's just say, and this is a little serious, let's say you were a government that wanted to harm the West, but you didn't want to use bombs or guns to do it. How might you think about doing that? Well, one strategy might be to flood social media with anti-vaccination propaganda (Source: Broniatowski et al. *Weaponized Health Communication: Twitter Bots and Russian Trolls Amplify the Vaccine Debate*. *Am J Public Health*. 2018;108(10):1378-1384. doi: 10.2105/AJPH.2018.304567). But they've been even more clever than that—they've flooded it with both anti-vaccination propaganda and pro-vaccination propaganda, both posed in ways to create animosity towards the other group. "The stupid idiots that are opposed to vaccination" and "Those people that are in cahoots with pharma and the FDA to make up the story that vaccination is good to make money and cause autism."

And then finally, let's say you just wanted to harm others through cyberwarfare. The very day the Affordable Care Act was passed, social media was flooded with anti-ACA propaganda;

academicians demonstrated that a significant amount of it was coming from Russian sources, specifically trying to convince people that the expansion of Medicaid was a socialist plot (Armour S and Overberg P. *Wall Street Journal*. Sept 12, 2018. Available at: <https://www.wsj.com/articles/nearly-600-russia-linked-accounts-tweeted-about-the-health-law-1536744638>). And, if you remember the original maps I showed of what we call the red zone problem, it looks like it's been pretty effective if you look at the mortality rates that I showed: states that did not expand Medicaid have higher mortality rates.

So, I'm going to end on a positive note here, but I hope I've gotten your attention. Given the massive improvement in ability to deal with information that I've described, it's all about communication. Part of it is how do you get bad news to people so that they're motivated to improve their individual or family health or the health of their neighborhood? But the other part is how do you get solutions out there in a way that people can react and do something about it? And part of it is how are we going to explain the sweeping implications of the fourth industrial revolution so that it can be guided to good rather than harm?

I want to close with a picture of what I think health care may look like about 5 years from now if we succeed (Figure 5). First of all, you and your clinicians will work together with access to the whole spectrum of data going all the way from your genome to your health care data from the EHR to your behavioral characteristics that may feed into your health outcomes and social and environmental data. (Right now, your doctor has <5% of the data that's available about you.) When you have all the data, the right analysis is done with your assent. It must be done jointly so that you have control over that information. We'll be able to make much better decisions about screening and diagnostic strategies, as well as therapeutic choices. And as this world of information gets better and better and of higher quality, each incremental piece of information will add to what is already known in a manner that can inform key decisions. This improved information management will lead to better decisions for individuals and families, and it will also enable better policies for neighborhoods, precincts, counties, and populations.

As we've learned, your behavior is not simply a matter of what you decide yourself, particularly for men. It looks like somewhere between 70% and 80% of family health decisions are made by women (<https://www.healthline.com/health-news/women-make-80-percent-of-health-decisions-120314#1>). There's even an understanding now that many women are making all the decisions for multiple generations. How do you serve out the information to make it efficient for people to make good decisions about their health and the health of the people they care about?

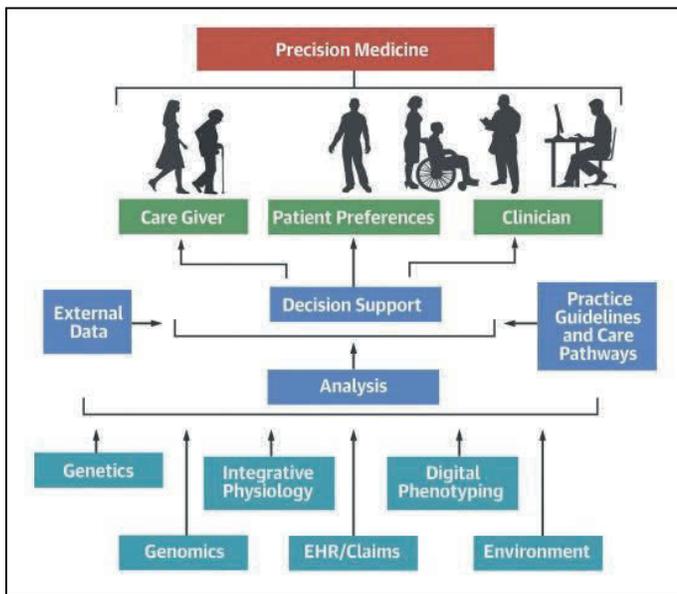


Figure 5. Precision medicine. Reprinted from *J Am Coll Cardiol.* 72, Califf RM, *Future of personalized cardiovascular Medicine JACC State-of-the-art review*, 3301–3309, Copyright 2018, with permission from Elsevier.

And then for neighborhoods and populations, this is really just a sum of all of this information. It can be aggregated at any level and people can benefit from high-quality analyses combined with clinical and public health expertise. If you're from a neighborhood with bad health outcomes and we were looking at data from a city in the US—I won't name the city—where lead poisoning is phenomenally high in children who live right along a particular river, we can now see this because we can get access to the information. I think people should have the right to see the aggregated information about the places where they live. And I think the politicians should be held accountable for the policies that lead to these outcomes.

Hopefully this has given you a few ideas to think about, and we can retire to the bar pretty soon. But I'm happy to take any questions that you have. Thanks.

Online Exclusive From:

Worst Practices for Writing CME Needs Assessments: Results From a Survey of Practitioners

Donald Harting, MA, MS, ELS, CHCP and Andrew Bowser, ELS, CHCP

67 Responses Describing Poor NA Writing Practices

A needs assessment that is 100% literature review

As much as peer-reviewed research is essential, for a needs assessment the writer must get a firm grasp on the current thinking and current issues relevant to the educational gap. EG, in obesity, the previous writer completely overlooked the new biological developments in the field that needed education and missed the boat on how clinicians needed to change their behavior.

Atrocious grammar! Writing needs assessments that do not meet the ACCME requirements

Cites outdated research or fails to acknowledge new developments that discredit previous findings

Cookie cutter approaches, poor judgement, recycled from one therapeutic area to another.

Data dump that does not get to the actual gaps in clinical practice or why there is an unmet need

Do you get a chance to talk to prospective faculty members before writing the needs assessment? Do you receive a sponsor's RFP before you start writing?

Does not identify a need, but rather why they want to have the education (and sometimes these are personal goals).

Exhaustive medical literature reviews that contain information that sponsors already know with little focus on practice or knowledge gaps.

Failure to link gaps to poor patient outcomes

Failure to use up-to-date literature, valid sources, and failure to discuss potential grantor's class of agent

Focus on whole natural history of a disease. The focus should be on the gap, and assume that the NA reviewer has some understanding of the disease.

Dense narrative— summaries and bullets are essential to get the point across.

Poor command of grammar/punctuation, eg, single quotes when double quotation marks are required; period outside the quotation mark (that's the British way; in the US, the period goes inside the quotation mark). Common misspellings, like "alot" for "a lot" or "lead" when what's meant is "led."

Gap statements that are not supported with evidence

Heavily referenced tertiary sources without primary source referenced

Inadequate or haphazard attribution of sources; myopic discussion of drugs at expense of other forms of therapy (surgery, radiation etc.); incomplete identification of key opinion leaders quoted in NA; non-standard or peculiar formats for citing references in text and listing entries in table of references at end of document; failure to detect and edit out references to details contained in previous versions but deleted from submitted version of document; failure to proofread and format in a manner designed to aid comprehension

Inadequate referencing, outdated referencing

Including a large part of information that are generally well known. Choosing small-scale studies or those not relevant to the target population.

Insufficient references

I've seen many NAs that spend pages on results of clinical trials but don't state the gap or educational need very well. Is it emerging data that has been presented at a specialty medical meeting? Is it evidence of conflicting data? Is it contrary to clinical guidelines? Does it provide insight into patient selection?

Lack of citation

Lack of examination of clinician attitudes/beliefs

Lack of support for gap statements; poor writing skills (eg, organization, crafting sentences); poor grasp of subject matter; failure to adequately rewrite when given a needs assessment to update.

Length of NA, poor strategic support of identified gap, lack of figures/charts, too many gaps/LOs, and multiple LOs for one gap or vice versa (should be 1:1 most of the time).

Listing secondary sources, using old references as support

Little correlation between NA narrative and educational learning objectives, that is, NA narrative does not support LOs, and need not properly identified.

Low data literacy, copy and pasting Pubmed, limited focus on pre- and post-evaluation assessing quality of intervention instead of impact on patient outcomes, lack of rigor or granularity to capture the myriad of influences at the point of care, multiple choice format, poor survey quality (satisficing, bias, selection bias, poor choice architecture)

Making up faculty quotes, making up outcomes data, plagiarism (ie, not citing sources or paraphrasing), not using primary sources

Making/exaggerating gaps claims without solid info to back it up

Too much background/introductory info

Mis-numbering of references. Happens quite a bit when an NA is refreshed.

Most providers do not understand what a needs assessment is however, when you ask them to simply "brain dump" on the topic and take notes, they give you everything you need to rewrite their needs assessment.

None really. The use of news articles is a stretch but sometimes they help to emphasize an initial peer reviewed point.

Not a thorough literature search to identify references that back up the need for the activity

Not citing current guidelines

Not citing original sources

Not getting input from accredited provider before submission (for joint providership projects)

Not having strong enough support for gaps in education.

Outdated or inapplicable references

Out-of-date (i.e., > 10 yrs.) references or citations.

Plagiarism

Plagiarism

Plagiarism; misinterpreting, misrepresenting and/or embellishing outcomes data to favor the need for education; providing insufficient or no evidence for statements about need for education

Plagiarizing, bias, too long, too much disease background, no actual data to justify gap

Poor coverage of REASONS for gaps

Poor grammar.

Poor grammar/formatting, poor narrative structure, too much industry influence, lack of educational outcomes data OR heavy reliance on outcomes data at the expense of current science.

Poorly written, redundant, not matching specific learning objectives to identified practice gaps

Reading only abstracts of papers

Relying on outdated outcomes data to demonstrate a need for education (ie, in oncology).

Sloppy writing of objectives

Pretest and posttest questions that don't reflect mastery of information or intent to change practices

Some writers I have seen do not organize well. Some editorialize too much and put in personal opinions about the politics of healthcare. Some do not show educational need—they just review clinical data.

Some writers seem to cut and paste info from clinical studies without putting it into context. I also sometimes see extremely long needs assessments that give a bunch of very basic info that supporters are already familiar with--it sort of clogs up the needs assessments, making it difficult to find the stuff that really matters. I've also seen many needs assessments that give a thorough background on a disease state but never get around to establishing a gap. Finally, this should be obvious, but many writers don't seem to proofread their work before handing it over. And I've heard from supporters that some freelancers turn in essentially the same proposal on behalf of multiple clients which seems dishonest.

Sometimes, in the interests of securing a grant, the content is made so specifically friendly to the grantor's product (if they have one) that it strays from a true educational directive

Spinning the NA to favor the potential grantor's products.

The "book report" approach that provides an overview of existing and emerging developments in the therapeutic area without actually demonstrating any specifics of the need for education beyond "there is so much new information and clinicians have trouble keeping up."

They're too vague or rely completely on what an individual provider sees in practice.

Too much disease background unrelated to gaps. Poorly supported gaps. Too much scientific data that is more appropriate for the actual activity.

Too much filler on disease state information not directly related to a professional practice gap; LOs that are not easily measurable

Too much focus on literature review vs. gap analysis

Too much re-purposing of very general needs assessments...not matching the gap to the LO and then the outcome to be measured

Types of articles used..ie source and publication type.

Typos and cutting and pasting errors

Unclear structure of document

Unreferenced statements in support of key messages.

Updating old needs assessments sounds like a shortcut, but it's often a detour. The risk is creating a rat's nest of detail that loses sight of the big picture. Sometimes it's best to tear down the house and rebuild it, rather than putting on another layer of duct tape.

Using press releases from pharma as references; producing NAs that are pastiches of previous NAs; using "canned" language to describe strategies

Using references that have not been peer-reviewed.

Commercial bias.

Using survey data that is non-representative to justify an unmet need, such a survey of a sample of physicians in which only a small percentage respond, no comparison is made to justify that the sample is generalizable, and no limitations are stated regarding the sample