

Modernizing Medical Attribution

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Proper attribution is a key component of any program attempting to successfully adopt value-based care or report on quality measures.^{1,2} With proper attribution, providers both know their population and know that the rewards (or punishments) they receive stem from patients whose medical outcomes they have influence over. To anyone outside of medicine, the very idea that there may be ambiguity in attribution must seem surreal. How many lawyers, architects, or electricians would agree to payment based on clients who may or may not actually be theirs?

The challenge of attribution in medicine stems from multiple factors, including lack of a designated PCP; obtaining care from multiple physicians in multiple networks; and the variation in the quality of and access to the data sources (e.g., the broader picture from claims vs. the deeper picture from EHR data) that define patients' interaction with the healthcare system.³ The challenge of developing an accurate attribution model is embodied in the fact that there are over 150 *different* models currently proposed or in use.¹ Multiple groups have attempted to address this challenge by surveying the landscape of attribution models and proposing general principles and approaches.^{4–7} The key factor in most of the proposed (and all the implemented) approaches, however, is that they attempt to match a patient to the single, most likely doctor and/or the single, most likely organization responsible for that patient's care. Even with this seemingly straightforward goal, and with nearly all healthcare organizations having access to the same types of data about their patients, there is no gold standard for attribution. The relatively coarse one patient-one organization approach may seem necessary because of the data complexity and the need to come to a decision so that patients and organizations are not left in attribution limbo, but this does not have to be the case. Examples from other industries can provide models for medical attribution that do not sacrifice accuracy for simplicity and ideally lead to a single, agreed-upon standard.

Current multi-attribution models generally just attribute patients to different providers with the same level of credit, not with different weights.⁵ An approach to modernizing medical attribution is moving from a full credit to a partial credit model, so that rather than giving credit to a single entity, the contribution of each is weighed and credit is distributed according to those weights. Unlike, say, the automobile industry, where the contribution of different parts suppliers is easy to measure, the ambiguity present in medical attribution requires approaches that are more capable of abstraction. One example comes from the NBA, where analytics group calculate statistics like player-specific “win shares,”⁸ which, as the name implies, quantify each player's contributions to a team's overall wins. The process that normalizes and compares a point guard's assists and a center's blocks could be the conceptual foundation for one that similarly normalizes and weighs the contributions of different physicians or organizations to a patient's overall health. A similar example comes from Internet marketing, where algorithms behind “multi-touch attribution” (MTA)⁹ give credit to the different advertising “channels” (e.g., a Google ad, the website article it links to, and the call that is requested after the article is read) that lead to the eventual sale of a particular product. In “single-touch” marketing attribution, only one of these steps—most likely the sales call—would get the credit for converting the prospect to a customer, ignoring the other fractional, yet important, contributions of the other steps in the process.¹⁰ In contrast, MTA uses weighted models to split the revenue fairly among all the steps in the campaign.

The above are just two examples of successful processes for distributing credit and responsibility that exist outside of medicine and that could be adopted to help modernize the medical attribution process. What would a weighted multi-attribution model (WMAM) look like in medicine? Rather than the simple assignment of full responsibility for a specific patient, organizations or providers would be measured on the actual contribution to care and outcomes. A WMAM would also allow for the equitable distribution of responsibility outside of primary care. Endocrinologists, ophthalmologists, and nutritionists could be rewarded proportionally for helping manage and prevent complications in patients with difficult to control diabetes. Orthopedic surgeons and physical therapists could be rewarded for helping patients get out of the hospital and stay out of rehabilitation centers after surgery. Using a WMAM would not only incentivize truly team-based, multi-disciplinary care but also give more transparency into which

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parts of the team are contributing the most to improved outcomes. The process of developing a WMAM would also provide an opportunity to uncover and address cases of “medical homelessness,”¹¹ since patients who have the most fragmented care would most likely also be the most difficult to accurately attribute.

A set of hypothetical cases can help illustrate how a WMAM-based model would work in practice. Assume a well-controlled, 50-year-old, female diabetic patient who sees a PCP, an endocrinologist, an ophthalmologist, and a podiatrist for routine care; sees her gynecologist for a well-woman exam; and gets both a colonoscopy and a mammogram all in the same year. Because every visit was for routine care, in a model that optimizes accuracy and weights according to outcomes, attribution would be divided equally among the providers. For a similar patient, however, with uncontrolled diabetes and diabetic retinopathy, who returns to her endocrinologist and ophthalmologist multiple times in the year, but whose PCP has made referrals but not adjusted her medications, the heavier attribution weights would apply to these specialists. What if the first patient’s colonoscopy shows colon cancer, so she sees a colorectal surgeon and an oncologist the following year and sees her PCP once for referrals? In this situation, attribution should again be weighted heavily toward the specialists.

Of the many arguments against a weighted approach to attribution, the most prominent is its potential complexity. One can imagine the attempt to find a perfectly tuned algorithm that constantly updates dynamic weights and distributes attribution to the third decimal point. Similarly, one can imagine the conflicts generated by perceived inequalities in assigning weights and the opportunities for lobbying and other attempts to introduce inefficiencies into a WMAM-based system. Using a single physician-patient or institution-patient dyad as the basis for attribution makes contracting and reporting simpler, and if the system chooses to optimize for simplicity, then there is no real need to change current methods. However, if we choose to optimize for fairness, accuracy, and transparency, we will understand that arriving at a gold standard algorithm that evaluates medical inputs and outcomes will take time and investment, and that with sufficient effort, we will arrive at an algorithm that reflects as accurately as possible the inputs and outcomes that medical providers can control.

At this point, the challenges around modernizing attribution are both philosophical and technical, since the industry would not only have to change its approach but also then come to a consensus on how to implement that change. The increasing implementation of sophisticated algorithms across medicine in areas from clinical decision support to predicting no-shows, however, should make the community more receptive to adopting an attribution approach that employs similar algorithms. Similarly, the democratization of knowledge about how these algorithms work and are developed would also put the medical community in a strong position to give input

into both the development and adoption of new models. A call for the development and adoption of a new, gold standard WMAM would undoubtedly spur a great deal of research since payers, and regulators would all be interested in accurately measuring their contributions to the care process. Developing these models in medicine would also be an opportunity for groups across medicine and technology to work together and learn from each other, ideally leading to progress in areas beyond attribution.

Adopting WMAM in medicine would be a complex undertaking and could possibly lead to negative incentives. Additionally, there is no guarantee that a WMAM will work better or lead to better outcomes than the current system. For example, an institution may choose to focus only on patients for whom 60% (or some arbitrary level) is expected to be attributed to them. Unless a gold standard model is adopted, healthcare providers may remain in their current state of attribution limbo, never be sure of their exact level of responsibility for a patient. Multi-attribution algorithms also could have the potential for gaming, leading to incentives for more, lower level visits to build up the impression that the bulk of care is occurring at a single organization (or at a competing organization depending on the costs associated with a particular patient). Additionally, finding a balance between implementing a more accurate, weighted attribution model and the practicalities of running a healthcare system may be difficult, leading some providers or institutions to prioritize control or efficiency over “fairness” and therefore also leading to a preference for the status quo.

Of course, many of the above weaknesses characterize the current attribution system, as evidenced in a number of times CMS has changed its approach to attribution since the ACO movement began. The benefit of developing a gold standard WMAM is the ability to both learn from the data and to arrive at a solution that assigns weights based on what happens to patients, rather than on hypotheses around how their care should look. The goal of the solution would not be focused on balancing payments, but on obtaining a transparent view of who is doing what and to what outcomes the “what” is contributing.

A WMAM approach would most likely begin by establishing a minimum threshold for contribution to a patient’s care that would have to be reached to be considered to receive credit. Models would also probably begin by putting more weight toward primary care and be reworked and recalibrated periodically to minimize gaming or other unintended consequences. Having a single, gold standard algorithm would reduce uncertainty, improve transparency, facilitate investment, and above all ensure that all parties involved in attribution work from the same fair starting and ending points.

How could we realistically go from 150 models to 1? Like many sociotechnical issues in medicine, the socio-related challenges are far larger than their technical counterparts. First, CMS and organizations such as the National Quality Forum should form a public-private partnership to manage the

process and provide financial resources to support new model development. An important aspect of this partnership should be patient education about the importance of attribution so that they be allies with their physicians in working toward a more accurate and equitable model. Part of this education would include information and processes for *self-attribution*,⁴ which, in many settings, would obviate the need for models and give a much more accurate picture of the patient's experience. Evaluating prospective vs. retrospective approaches, the correct approach for weighing primary vs specialty care, and the interactions of any new attribution model with population health strategies and other care that occurs outside of the traditional clinical visit are 3 of many basic tasks that would need to be completed before arriving at a consensus model. Because of the complexity and the scope of modernizing medical attribution, the Center for Medicare and Medicaid Innovation is an ideal place for the development to happen. We also must enter the process with the understanding that version 1 will not be perfect, that pilots will be necessary, and that the model's development will require a great deal of iteration until we achieve the gold standard.

A decade ago, a group of health policy experts noted that “[i]n the long run, payers and providers may benefit from the development of a single, consistent attribution method for both medical home and ACO reforms.”² Now that value-based care is modernizing the way medicine is practiced and care is delivered, and healthcare organizations are already using sophisticated algorithms in areas ranging from analyzing retinal images to predicting length of stay, a concerted, well-funded effort could modernize attribution and more fairly distribute both responsibility and rewards for care and outcomes.

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Compliance with Ethical Standards:

Conflict of Interest: The author is a full-time employee of the Regeneron Genetics Center. His work there is completely unrelated to the subject of this article.

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