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MANAGING CUMULATIVE RISK

Lauren R. Roth[†]

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I. INTRODUCTION

“Life is messy and full of compounding consequences.”¹ Although environmental law professor Sanne Knudsen was writing about the cumulative public health risk of exposure to chemicals and pesticides,² these words could just as easily apply to the various public

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1. See Sanne H. Knudsen, *Regulating Cumulative Risk*, 101 MINN. L. REV. 2313, 2314 (2017).

2.

[R]egulatory safety standards need to consider the public health implications not from any single chemical but from the combination of multiple chemicals with common mechanisms of toxicity. It is the potential for combined and synergistic harm that needs attention. In fact, so important is this need that the failure to systematize the considerations of cumulative risk may amount

health risks managed by healthcare organizations. Little is known about the cumulative risk for healthcare organizations.³

Any attempt to assess and manage cumulative risk within healthcare organizations raises similar issues to those involved with managing risks individually. For example, it is not always clear what the consequences of inappropriate staff behavior or a cybersecurity breach will be in the real world given the many contingent factors—including the type and number of patients affected, the speed at which the risk is contained, and any redress made to the patients and staff members affected.⁴ These uncertainties arising from individual risks force those who need to prepare for and reduce predictable risks to make assumptions about human behavior.⁵

However, assessing cumulative risk in healthcare organizations presents an additional layer of uncertainty. In assessing cumulative risk, we need to evaluate whether the timing of events (and the order in which they occur) matters when assessing their potential cumulative impact.⁶ Further, the response to the first incident may affect the consequences of, or response to, the second.⁷ Finally, the possibility of multiple system failures may affect both an organization's response and the behavior of patients and staff members.⁸

In spite of the uncertainties, this article draws on cumulative risk assessment methodology developed by the field of environmental

to 'arbitrary and capricious' decision-making.

Id. at 2320.

3. *See, e.g.*, Dan Moskowitz, *The Importance of Healthcare Risk Management*, INVESTOPEDIA (July 23, 2015, 10:20 AM), <https://www.investopedia.com/articles/personal-finance/072315/importance-healthcare-risk-management.asp> [<https://perma.cc/UG4D-SQDJ>] (describing prudent healthcare risk management as a prioritization of individual risks based on their likelihood and potential severity).

4. *See id.* at 2333. Professor Knudsen describes “model[ing] real-world exposure scenarios” to understand the risk presented by chemicals. *Id.* Modeling the impact of specified risks is made more difficult by “informational challenges.” *See id.* at 2335–43 (noting the need to understand “exposure pathways, how frequently people are exposed, [and] concentrations at which exposed” to manage cumulative chemical risks).

5. *Id.* at 2336.

6. *See id.* at 2335 (“[T]iming of exposures to various chemicals may matter because exposure to one chemical may make an individual or community more susceptible to a later in time exposure to a second chemical.”).

7. *See id.*

8. *See id.* at 2335–38.

regulation and adapts it to the healthcare context.⁹ This article first examines the increasing prominence of cumulative risk in environmental law, where the quantity and variety of chemicals and pollutants have highlighted the need to address the interaction of different environmental hazards.¹⁰ The article then discusses how current risk assessments by healthcare organizations are too segmented in that they view risks in isolation or evaluate multiple risks based on a simple additive principle—the harm associated with the cumulative risk is the sum of the damage of each individual risk had it occurred in isolation.¹¹ Next, this article addresses the importance of cumulative risk assessments for healthcare organizations.¹² Recent natural disasters and mass casualty events¹³ show that assessing simultaneous and interacting risks is imperative to making health organizations safer for patients and staff. Finally, this article proposes adopting the same framework used in the environmental context for evaluating cumulative risk in the healthcare context.¹⁴

II. CUMULATIVE ENVIROMENTAL RISK

In environmental law and regulation, cumulative risk means “[t]he combined risks from aggregate exposures to multiple agents or stressors.”¹⁵ Cumulative risk assessments are not simply lists of all individual risks that a population faces.¹⁶ Instead, they “study how various stressors interact with one another and impact the given population when considered in combination.”¹⁷ The impact of

9. See *infra* Part IV.

10. See *infra* Part II.

11. See *infra* Parts III.A–III.B.

12. See *infra* Parts III.C–III.D.

13. See generally Deborah Simmons, *The Greeks Have a Word for What Happened in Las Vegas*, WASH. TIMES (Oct. 2, 2017), <https://www.washingtontimes.com/news/2017/oct/2/las-vegas-shooting-one-in-a-string-of-mass-casualt> [<https://perma.cc/S3JJ-KQQA>] (providing a list of recent mass casualty events); *The Deadliest Natural Disasters of 2017*, TELEGRAPH (Oct. 3, 2017, 8:00 AM), <http://www.telegraph.co.uk/education/stem-awards/design/deadliest-natural-disasters> [<https://perma.cc/CH5K-5RFM>] (providing a list of recent natural disasters).

14. See *infra* Part IV.

15. RISK ASSESSMENT FORUM, EPA, FRAMEWORK FOR CUMULATIVE RISK ASSESSMENT 72 (2003).

16. *Id.* at xvii–xx; Knudsen, *supra* note 1, at 2324–25.

17. Knudsen, *supra* note 1, at 2324–25.

multiple risks can be additive or synergistic.¹⁸ In fact, cumulative risk assessments may not even be quantitative, depending on the stressors and the data available.¹⁹

Cumulative risk assessments in environmental regulation look beyond the direct impact of something like a chemical exposure to other effects such as stress, which can worsen the impact a chemical has on a population.²⁰ As with much of health law (and its increasing focus on the social determinants of health), cumulative risk assessments focus on populations instead of individuals.²¹ The assessments can evaluate the way different chemicals impact populations through a single exposure route (*e.g.*, drinking water) or multiple exposure routes.²² They can evaluate one outcome or multiple, interactive outcomes.²³ Cumulative risk assessments can even assess how stressors impact particular subpopulations that may be more vulnerable.²⁴

A. *Building Consensus*

In recent years, environmental law scholars and regulators have agreed that cumulative risk assessment is a useful tool in the protection of the public from chemical exposures.²⁵ One example is

18. *Id.* at 2325 (identifying additive interactions as including instances where “the total risk can be calculated by adding up the individual risks posed by each of the chemicals over all identifiable exposure pathways,” and defining synergistic interactions as “more complicated” than additive interactions and as including situations where “two or more stressors combine [in] such [a way] that the combination of stressors is worse than the impact of the individual stressors simply added together”); Ken Sexton, *Cumulative Risk Assessment: An Overview of Methodological Approaches for Evaluating Combined Health Effects from Exposure to Multiple Environmental Stressors*, 9 INT’L J. ENVTL. RES. & PUB. HEALTH 370, 371 (2012) (“The potential for interactions among mixture constituents to produce synergistic effects is well known (*e.g.*, increased risk of lung cancer from combined exposure to tobacco smoke and radon) . . .”).

19. See RISK ASSESSMENT FORUM, *supra* note 15, at xvii, 7–9.

20. *Id.* (“[Additive or synergistic] stressors need not be chemical; they can also be physical, biological, or social.”).

21. *Id.* (“[P]erhaps the most important conceptual feature of cumulative risk assessments is their focus on population-level analysis.”).

22. See *id.* at 2 n.1.

23. Knudsen, *supra* note 1, at 2326.

24. See *id.* at 2327.

25. See Sexton, *supra* note 18, at 371 (“It is becoming apparent, however, that a more holistic approach is necessary if risk assessment is to remain a relevant and reliable decision-making tool.”); see also Knudsen, *supra* note 1, at 2323–24 (“[T]he

the Food Quality Protection Act of 1996's requirement that the United States Environmental Protection Agency (EPA) focus on the cumulative risk of chemical exposures.²⁶

The EPA set out its Framework for Cumulative Risk Assessment ("Framework") in May 2003.²⁷ The Framework is not binding, although it may serve as a basis for future regulation.²⁸ The EPA admitted that not all suggestions are applicable to each analysis and that "[f]or some areas . . . the methodology for conducting the risk analysis may not yet exist."²⁹ In fact, the data needs of many cumulative risk assessments may mean that the "identification of critical information and research needs may be the primary result of many cumulative risk assessment endeavors."³⁰

The Framework sets forth three phases to a cumulative risk assessment: "(1) planning, scoping, and problem formulation, (2) analysis, and (3) risk characterization."³¹ In the first phase, risk managers and stakeholders set out the goals and the scope of the assessment by producing a conceptual model and an analysis plan.³² The conceptual model determines the stressors and/or impacts to be assessed, and the relationships between the stressors and their impacts.³³ The analysis plan sets forth the data needed, how to obtain it, and the expected end point.³⁴ Next, the analysis phase determines likely exposures and interactions among stressors, "predicting risks to the population or populations assessed."³⁵ Finally, in the risk characterization phase, the significance of the risks are put into context and, after considering any assumptions and missing data,

National Research Council's 2009 Report . . . warned that risk assessments are themselves at risk of becoming irrelevant unless they start accounting for cumulative impacts.").

26. See RISK ASSESSMENT FORUM, *supra* note 15, at x-xi ("Assessing cumulative risk through complex exposures is one of the Agency's high priorities, especially in light of FQPA mandates.").

27. *Id.* at x.

28. *Id.* at xvii ("Although this framework report will serve as a foundation for developing future guidelines, it is neither a procedural guide nor a regulatory requirement within EPA, and it is expected to evolve with experience.").

29. *Id.* at xi.

30. *Id.* at xii.

31. *Id.* at xviii.

32. *Id.* at 14-15.

33. *Id.* at 24.

34. *Id.* at 28-29.

35. *Id.* at xviii.

determine the reliability of the assessment.³⁶ As summarized by the Framework:

Because of the limitations of current science, cumulative risk assessments done in the near future will not be able to adequately answer all the questions posed by stakeholders or interested parties. This does not mean, however, that they cannot answer *some* of the questions; in fact, cumulative risk assessment may be the best tool available to address certain questions dealing with multiple-stressor impacts.³⁷

The EPA has devoted substantial resources towards promoting cumulative risk assessments and researching models of exposure to multiple stressors.³⁸

Methods for assessing cumulative risk in the environmental context can be roughly divided into stressor-based methods for chemical exposures and effects-based methods from the interaction of chemical and nonchemical stressors.³⁹ Stressor-based methods ask, “what health effects are related to a defined set of stressors,” while effects-based methods ask, “retrospectively . . . which stressors explain observed or hypothesized health effects in a population or community.”⁴⁰ While varying frameworks for implementing these methods have been proposed, “[t]he reality is that quantitative analyses are impractical in the context of many real-world problems because data on interactions among environmental stressors are scarce, information on place- and population-specific exposures is lacking, and verified mechanistic models relating exposure to effect are unavailable.”⁴¹

36. *Id.* at xviii.

37. *Id.* at xx.

38. See Knudsen, *supra* note 1, at 2339–41. Some lessons learned from the EPA’s work include “the iterative nature of CRAs, importance of considering vulnerability, need for stakeholder engagement, value of a tiered approach, new methods to assess multiroute exposures to chemical mixtures, and the impact of geographical scale on approach and purpose.” Sarah Gallagher et al., *Cumulative Risk Assessment Lessons Learned: A Review of Case Studies and Issue Papers*, 120 CHEMOSPHERE 697, 697 (2015). Tiered approaches can help screen out stressors of limited impact, focusing the assessment on higher priorities. *Id.* at 701. However, there must be a reason for screening out a particular stressor and there must be attempts “[t]o prevent stressors from being screened out inappropriately.” *Id.* Using conservative screening criteria can ensure that all important risks are analyzed. *Id.*

39. Sexton, *supra* note 18, at 379.

40. *Id.*

41. *Id.* at 381.

Instead, some have proposed focusing on “evaluation of risk management options instead of characterization of problems.”⁴² Benefits of this approach include a focus on environmental justice for vulnerable populations and the need to analyze quantitatively only a small group of stressors relevant to the cost/benefit analysis for decision making.⁴³ Yet the difficulty in assessing cumulative exposure to multiple varying stressors remains.

B. Legal and Administrative Failures

The promise of cumulative risk assessments has largely gone unfulfilled despite a growing consensus on the importance of such assessments.⁴⁴ Some of the delay relates to the difficulties in conducting cumulative risk assessments. The EPA assumes that the impacts of stressors are additive because the synergistic impact is unknown or incalculable because of many uncertainties.⁴⁵ The impact of stressors in the real world, instead of in models, incorporates many variables and assumptions that make the model unreliable at times.⁴⁶ A model is only as good as its inputs, and cumulative risk assessments require knowledge about the effects of stressors in combinations that may not be available.⁴⁷ The timing and order of multiple exposures to stressors can also change the impact, assuming that one can make the impact of the others worse or perhaps mitigate the effects.⁴⁸

The EPA does not regularly consider cumulative risks. Although it has issued guidelines, these remain “voluntary and informational measures.”⁴⁹ Yet, if cumulative risk is difficult for experts to calculate,

42. *Id.* (“[S]tressors would only be included in the cumulative risk assessment to the degree that they influence the estimated benefits of a control option either in its estimation or interpretation.”).

43. *Id.*

44. *See generally* Knudsen, *supra* note 1.

45. *Id.* at 2332–33.

46. *See id.* at 2333, 2337 (“Because the goal of cumulative risk assessments is ultimately to model real-world exposure scenarios, understanding what happens to chemicals when released into the environment is an expected part of the assessment process.”).

47. *Id.* at 2335–56 (“Even if researchers are confident in the theoretical models—e.g., choosing additive interactions over synergistic—the confidence in the ultimate assessment will be a function of the quality of the data inputs to the theoretical models.”).

48. *Id.* at 2334.

49. *Id.* at 2342 (“Within EPA program offices, there is no agency-wide policy

individuals in the public will not be able to accurately assess cumulative risk.⁵⁰ Even if individuals could accurately assess risk in the environmental context, they “cannot opt out of exposure to toxins.”⁵¹ Finally, vulnerable populations may suffer disproportionately from the cumulative risks of chemical exposure.⁵² The lack of regulation based on cumulative risk is a result of statutory deficiencies, failures in implementation, and court decisions that hold regulators to an impossible standard when attempting to ban or limit the use of particular chemicals and prioritize economic impact over health impact.⁵³ To move forward, decisions need to be made about which stressors to regulate and how to do so. Assuming decision-makers can somehow reach agreement that a cumulative risk is “unreasonable,” the question then becomes which component risk to regulate and how to do so.⁵⁴

for considering cumulative risks when making environmental decisions.”).

50. *Id.* at 2353–55.

51. *Id.* at 2355 (“The existing regulatory regime—which for decades has left open the toggle switch for chemicals entering the marketplace and environment—has created public health externalities that require collective regulatory action to resolve.”).

52. *Id.* at 2362–64 (discussing the four reasons for vulnerability—“exposure, susceptibility, preparedness, and responsiveness” and noting that “poor nutrition, noise, obesity, or psychosocial stress can impact a body’s ability to recover from harmful exposures” and “[n]ot every family has the means to buy organic foods or move to a neighborhood with cleaner water”); Sexton, *supra* note 18, at 374 (“There is mounting concern that exclusive focus on chemicals is overly narrow, needlessly restrictive, and clearly inadequate to address the totality of cumulative health risks from people’s real-world exposures to a diverse and dynamic combination of both chemical and nonchemical stressors. Consequently, efforts are underway to develop approaches and methods that incorporate nonchemical stressors, especially psychosocial factors (e.g., low income, meager education, substandard diet, unsafe neighborhoods, dilapidated housing, lack of access to health care), into cumulative risk assessments.”).

53. *See* Knudsen, *supra* note 1, at 2366–85.

54. *Id.* at 2393–94 (suggesting that decisions could be made “on the basis of several factors: which chemical is most toxic, the volume of the chemical in commerce, the usefulness of the chemical to social life, or the chemical that was the first to enter the marketplace . . . [perhaps giving] priority to the chemicals that are well studied”).

III. RISKS FOR HEALTH ORGANIZATIONS

A “risk assessment” is an analysis of the likelihood that a particular event will occur.⁵⁵ It is “a process whereby the magnitude of a specific risk is characterized so that decision makers can conclude whether the potential hazard is sufficiently great that it needs to be managed or regulated” and how to do so effectively.⁵⁶ Most environmental and health risk assessments focus on reducing risk to levels “as low as reasonably achievable,” or “ALARA,” because they recognize that few risks can be reduced to zero through management and regulation.⁵⁷

The Health Insurance Portability and Accountability Act (HIPAA) and the Sarbanes-Oxley Act of 2002 require risk assessments related to the protection of patient information as well as corporate fraud.⁵⁸ Hospitals and other healthcare providers typically focus on risks identified by the United States Department of Health and Human Services (HHS) Office of Inspector General (OIG), Centers for Medicare and Medicaid Services (CMS), and the Department of Justice (DOJ)—from regulations, laws, and investigations.⁵⁹ Most of this guidance focuses on claims and billing.⁶⁰

55. See Dennis J. Paustenbach, *Retrospective on U.S. Health Risk Assessment: How Others Can Benefit*, 6 RISK: HEALTH SAFETY & ENV'T 283, 283 (1995) (“As broadly defined, risk assessment can be used to predict the likelihood of many unwanted events, including industrial explosions, workplace injuries, failures of machine parts, natural catastrophes, injury or death from an array of voluntary activities, diseases, natural causes, life-style or others.”).

56. *Id.* at 287–88.

57. *Id.* at 288.

58. See DEP'T HEALTH & HUM. SERVS., GUIDANCE ON RISK ANALYSIS (2017), <https://www.hhs.gov/hipaa/for-professionals/security/guidance/guidance-risk-analysis/index.html> [<https://perma.cc/C2DX-V95Q>] (“Risk analysis is the first step in an organization’s Security Role compliance efforts.”); TIM J. LEECH, SARBANES-OXLEY SECTIONS 302 & 404: A WHITE PAPER PROPOSING PRACTICAL, COST EFFECTIVE COMPLIANCE STRATEGIES 39 (Carddecisions, Inc. ed. 2003), <https://www.sec.gov/rules/proposed/s74002/card941503.pdf> [<https://perma.cc/CBF4-E9NN>] (discussing the requirement of risk assessment processes at both a micro and macro level).

59. See, e.g., GLEN C. MUELLER, PERFORMING A COMPLIANCE RISK ASSESSMENT FOR COMPLIANCE AUDITING & MONITORING IN HEALTHCARE ORGANIZATIONS 3, <https://www.ahia.org/assets/Uploads/pdfUpload/WhitePapers/Article2Risk-Assessment.pdf> [<https://perma.cc/N3MD-WC6T>] (providing a list of categories compliance officers should consider when conducting a risk assessment, including information concerning the OIG, CMS, and DOJ).

60. See Michelle Ann Richards, *Risk Assessment: Why You Need It and How to Get Started*, HEALTHCARE BUS. MGMT. ASS'N (July 6, 2015), <https://www.hbma.org/>

Compliance efforts within healthcare organizations are meant to prevent “fraud, abuse and waste” while the organization provides high-quality healthcare to all patients.⁶¹ Not all “fraud, abuse and waste” is financial.⁶² The focus on financial fraud largely results from the easy availability of data and ability to quantitatively assess risk.⁶³ Regulatory bodies appear to focus their resources on these areas while avoiding other new and increasing risks that are difficult to quantify or manage.⁶⁴ However, while claims and billing issues may be important subjects for cumulative risk assessments, they should not be the *only* subjects.

Health organizations should also include accelerators in their risk assessments. Accelerators are sudden, intense events within healthcare facilities that are unexpected, cause patient care to deviate sharply from patient and provider expectations, and have the potential to operate synergistically with other such events and more routine risks.⁶⁵ I term such events “accelerators” because they can increase the magnitude or likelihood of other potential risk events. For patients, these events occur at a vulnerable time when their reactions may be heightened due to the nature of their position seeking care.

news/public-news/n_risk-assessment [https://perma.cc/944V-288E].

61. See *In re Caremark Int'l Inc. Derivative Litig.*, 698 A.2d 959, 969–72 (Del. Ch. 1996) (finding that failure to implement a compliance program may constitute a breach of a corporate Director’s fiduciary duties); Publication of the OIG Compliance Program Guidance for Hospitals, 63 Fed. Reg. 8987, 8987–88 (Feb. 23, 1998) (“Fundamentally, compliance efforts are designed to establish a culture within a hospital that promotes prevention, detection and resolution of instances of conduct that do not conform to Federal and State law, and Federal, State and private payor health care program requirements, as well as the hospital’s ethical and business policies.”).

62. See James D. Byrd, Jr. et al., *Health Care Fraud: An Introduction to a Major Cost Issue*, 14 J. ACCT., ETHICS, & PUB. POL’Y 521, 522 (2013) (“While fraud is typically discussed in financial terms, some health care industry frauds have an element that is not present in frauds affecting most other industries, i.e., individuals’ health and lives may be affected.”).

63. See generally Hossein Joudaki et al., *Using Data Mining to Detect Health Care Fraud and Abuse: A Review of Literature*, 7 GLOBAL J. HEALTH SCI. 194, 195–99 (2015) (discussing how electronic health records and other computer systems simplify the process of detecting fraud).

64. See Byrd et al., *supra* note 62, at 523 (“These frauds are not easily identified or quantified.”).

65. Cf. ACE Group, *11 Critical Risks Facing the Healthcare Industry*, RISK & INS. (June 1, 2015), <http://riskandinsurance.com/11-critical-risks-facing-the-health-care-industry/> [https://perma.cc/D4EF-UAMN].

Shifting the focus of risk assessments to include accelerators will require an acceptance of uncertainties and information gaps.⁶⁶ While “[n]ot all risks are equal, and not all need to be remediated,”⁶⁷ all should be understood. A conscious decision must be made about whether and how to address them. The consequences of risk reduction in one area may not even be known. It is possible that when one risk is decreased, another may increase.⁶⁸ The answer is not, however, to ignore risks that are difficult to evaluate.

This section discusses the four main categories of risk outside of the financial fraud and negligence that health organizations currently focus on.⁶⁹ Next, this section explains why evaluating each of these risks in isolation or as merely one risk among others is insufficient.⁷⁰ Finally, this section provides two examples of accelerators and then considers ways in which the healthcare community can build consensus about the need for such assessments as the environmental regulation community has done.⁷¹

A. *Defining the Risks*

Although the identification of risks is the first step of most risk assessments,⁷² this article is not focused on providing an exhaustive list of possible risks faced by healthcare organizations.⁷³ Instead, it

66. Cf. *Uncertainty and Variability*, EPA EXPOBOX, <https://www.epa.gov/expobox/uncertainty-and-variability> [<https://perma.cc/9UPP-BWNY>] (last visited May 2, 2018) (discussing uncertainty in exposure assessments conducted by the EPA).

67. Cornelia Dorfschmid & Steven D. Forman, *Meeting the Challenge of Adequately Addressing Numerous Compliance Risks: A Systematic Approach for Managing Multiple Compliance Risks All at Once*, 15 J. HEALTH CARE COMPLIANCE 19, 20, 22 (2013).

68. Mark Eliot Shere, *The Myth of Meaningful Environmental Risk Assessment*, 19 HARV. ENVTL. L. REV. 409, 471 (1995) (“For example, EPA engaged in an extensive quantitative risk assessment to evaluate the health risks from asbestos brake linings for cars. The agency concluded that the asbestos in the linings would cause a loss of over 102 ‘discounted’ lives from cancer, and proceeded to ban the use of such linings. The agency refused to consider, however, that alternative brake linings might have a higher failure rate, killing even more people in the resulting traffic accidents.”).

69. See *infra* Part III.A.

70. See *infra* Part III.B.

71. See *infra* Parts III.C–III.D.

72. See Dorfschmid & Forman, *supra* note 67 (recommending a nine-step process to risk assessment by healthcare organizations).

73. Not all risks are identifiable. Many are so rare that they are not on administrators’ radar screens or are considered too rare to be worth the cost of

focuses on four of the biggest areas of risk—staffing risks, cyber risks, short-term mass casualty emergencies, and long-term public health crises—to demonstrate the need for cumulative risk assessments. These four risks are currently receiving a significant and growing amount of public attention, as each has a high likelihood of resulting in substantial damage to an organization if it materializes.⁷⁴ While these particular risks illustrate the need for cumulative risk assessments, the particular examples are less important than the need to consider the risks together, as interactive stressors.⁷⁵ What follows is a discussion of some of those risks and how healthcare organizations, even when attentive to these important categories of risk, consider them in isolation.

The first issue is staffing risks. Staff at healthcare organizations have all of the interpersonal difficulties of a typical working environment magnified by the stressful context in which they work.⁷⁶ This stress can manifest itself in inappropriate language or hostility towards coworkers or patients.⁷⁷ The negative behavior of health organization staff also has a greater impact than other service industries because of the uniquely vulnerable position of patients.⁷⁸ At the most serious level, staffing concerns include the risk that employees or former employees will harass or assault co-workers, patients, or hospital visitors—or that these parties will harass or assault employees.⁷⁹ The consequences can include workers' compensation claims, malpractice liability, reputational harm, and

managing. *See id.* at 19–20 (“Although risk issues and areas are often defined by internal and external sources, many remain unknown or even unknowable at a point in time.”).

74. *Id.* at 22 (“Assessing risk has three aspects: the probability that risk comes true, the impact or damage to the organization if it happens, and the internal controls already in place that mitigate such damage.”).

75. *See id.*

76. *See The Top 10 Challenges Facing Healthcare Workers*, BECKER'S HOSP. REV. (Apr. 5, 2011), <https://www.beckershospitalreview.com/hospital-management-administration/the-top-10-challenges-facing-healthcare-workers.html> [<https://perma.cc/MEJ8-C76U>].

77. *See* Joint Comm'n, Div. Health Care Improvement, *Bullying Has No Place in Health Care*, 24 QUICK SAFETY 1, 1–2 (2016).

78. *See id.* at 2.

79. *Id.* at 3 (noting that the “incidence rate for violence and other injuries in the healthcare and social assistance sector in 2012 was over three times greater than the rate for all private industries”).

increased costs associated with “staff retention, morale and absenteeism.”⁸⁰

The second issue is cyber security risks. By using electronic medical records, the efficiency and accuracy of patient care has increased, but so has the risk of a security breach.⁸¹ A 2014 study estimates that cyber risks may cost a single healthcare facility \$2.2 million over a two-year span and the entire healthcare industry about \$6.2 billion per year.⁸² With many employees and contractors operating the recordkeeping system with the ability to access private records, there is a high risk for potential leaks.⁸³ As healthcare providers increasingly use email and other electronic means to communicate with patients, data concerns around telemedicine are increasing.⁸⁴

Among potential risks related to cyber security is the inability for certain operations at healthcare organizations to function if they are corrupted or held for ransom.⁸⁵ Hackers using ransomware have already attacked hospitals.⁸⁶ The first known instance of a ransomware attack on an American hospital occurred at the Hollywood Presbyterian Medical Center in California, where hackers demanded \$3.4 million and the hospital had to turn away patients because its computers were offline for over a week.⁸⁷ Some are

80. *Id.*

81. See generally Fouzia F. Ozair et al., *Ethical Issues in Electronic Health Records: A General Overview*, 6 PERSP. CLINICAL RES. 73, 73–75 (2015) (discussing the benefits of electronic health records and increased security risks).

82. PONEMON INST., SIXTH ANNUAL BENCHMARK STUDY ON PRIVACY & SECURITY OF HEALTHCARE DATA, 1 (2016).

83. See, e.g., Ozair et al., *supra* note 81, at 74 (elaborating on an instance where a healthcare employee abused her position as a hospital employee to access confidential patient information and then sold that information).

84. See DIANE DOHERTY & RENEE CARINO, CRITICAL RISKS FACING THE HEALTHCARE INDUSTRY 5–6 (2015), https://www2.chubb.com/microsites/_assets/doc/healthcare-risk-collateral/chubb-healthcare-critical-risk-whitepaper.pdf [https://perma.cc/XTK7-UWTM].

85. Zachary T. Steadman, *Ransomware and Healthcare Providers*, 51 ARK. LAW. 20, 20–22 (2016).

86. Jessica Davis, *Ransomware: See the 14 Hospitals Attacked So Far in 2016*, HEALTHCARE IT NEWS (Oct. 5, 2016, 12:13 PM), <http://www.healthcareitnews.com/slideshow/ransomware-see-hospitals-hit-2016?page=1> [https://perma.cc/YAQ2-Z2YL].

87. Anthony Cuthbertson, *Hospitals Are Critical Infrastructure ‘Most at Risk’ to ISIS Hackers*, NEWSWEEK (Oct 6, 2016, 10:07 AM), <http://www.newsweek.com/hospitals-most-risk-isis-hackers-506822> [https://perma.cc/48QP-RZ3J].

speculating that terrorists may try to hack hospitals to spread fear and to harm populations—not to seek money.⁸⁸ Insurance and security consultants can mitigate some of this risk but not all, particularly as technology advances quickly and healthcare providers struggle to keep up.⁸⁹

The third issue is short-term mass casualty emergencies. A mass casualty event can upend the usual business of emergency care.⁹⁰ The need to provide care quickly to an unexpectedly large number of patients can stretch resources and strain the mental health of staff.⁹¹ Further, news media, law enforcement, and family members all demand attention during these events.⁹² In some cases, the facilities of the healthcare organization itself may suffer damage or even require evacuation.⁹³ The crucial decision about when and whether to evacuate can have life and death consequences. Recently,

88. *See id.* (discussing how cybersecurity experts are concerned about terrorist attacks on healthcare systems).

89. *See* Joshua R. Levenson, Note, *Strength in Numbers: An Examination into the Liability of Corporate Entities for Consumer and Employee Data Breaches*, 19 U. FLA. J. L. & PUB. POL'Y 95, 122–23 (2008); Lily Hay Newman, *The Ransomware Meltdown Experts Warned About Is Here*, WIRED (May 12, 2017, 2:03 PM), <https://www.wired.com/2017/05/ransomware-meltdown-experts-warned/> [<https://perma.cc/B4RK-S8R7>] (“Hospitals make for popular ransomware victims because they have an urgent need to restore service for their patients. They may therefore be more likely to pay criminals to reinstate systems. They also often make for relatively easy targets.”).

90. *See, e.g.*, Frazer Maude, *Impact of ‘Mass Casualty Events’ on Health Staff*, SKY NEWS (Oct. 26, 2017, 3:53 PM), <https://news.sky.com/story/impact-of-mass-casualty-events-on-health-staff-11098873> [<https://perma.cc/DWL5-7PCF>] (explaining how several mass casualty events in England impacted local emergency care facilities).

91. *See id.*; *see also, e.g.*, Kenneth N. Ozoilo et al., *Challenges of the Management of Mass Casualty: Lessons Learned from the Jos Crisis of 2001*, 8 WORLD J. EMERGENCY SURGERY 1, 4 (2013) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3819470/pdf/1749-7922-8-44.pdf> [<https://perma.cc/4QVY-KLYG>] (“Hospital personnel who were trapped in the hospital for over 72 hours soon began to manifest features of physical and mental stress. Overwork was a major factor, but in addition, there was anxiety for personal safety, fear for the lives of loved ones, and worry over the eventual outcome of the crisis.”).

92. *See* DOHERTY & CARINO, *supra* note 84, at 7–8.

93. *Id.* at 8; *see also* SHERI FINK, *FIVE DAYS AT MEMORIAL: LIFE AND DEATH IN A STORM-RAVAGED HOSPITAL* (Crown Publishers ed., 2013) (describing patient deaths over five days at Memorial Medical Center during and after Hurricane Katrina).

residents of a Florida nursing home died after an air conditioner failed and the facility did not evacuate.⁹⁴

The fourth issue is the lack of resources of healthcare providers due to long-term public health crises, such as the increase in the percentage (and the decrease in age) of patients with chronic conditions associated with obesity.⁹⁵ Both staff members and patients are more likely to be obese than ever before.⁹⁶ Caring for obese patients results in a disproportionate share of injuries to healthcare workers and frequently requires special equipment.⁹⁷ Obese individuals also frequently have multiple health conditions complicating their treatment.⁹⁸ As a result, total hospital costs for obese surgical patients are roughly 3.7 percent higher than for non-obese patients.⁹⁹

B. *Isolationism*

Today, most healthcare organizations analyze these risks, if at all, in isolation. But what if the likelihood of each risk occurring depends on whether another risk occurs? What if the severity of the impact of one risk depends on whether another risk occurs? To determine how these risks interact, consider an example. Imagine

94. See Ellen Gabler et al., *At Florida Nursing Home, Many Calls for Help, but None That Made a Difference*, N.Y. TIMES (Sept. 23, 2017), <https://www.nytimes.com/2017/09/23/us/nursing-home-deaths.html> [<https://perma.cc/E5JP-D7ZE>].

95. See *Chronic Diseases and Conditions are on the Rise*, PwC, <https://www.pwc.com/gx/en/industries/healthcare/emerging-trends-pwc-health-care/chronic-diseases.html> [<https://perma.cc/D7XD-9BZ6>] (last visited Apr. 3, 2018); *Obesity Rates and Trends Overview*, STATE OF OBESITY, <https://stateofobesity.org/obesity-rates-trends-overview/> [<https://perma.cc/BV7C-B5TX>] (last visited Apr. 3, 2018) [hereinafter *Obesity Rates and Trends*] (discussing the rising trends in obesity rates).

96. See, e.g., *Obesity Rates and Trends*, *supra* note 95.

97. THOMAS H. WILSON, OSHA GUIDE FOR HEALTH CARE FACILITIES ¶ 763 (2015) (“A 2009 study . . . found that nearly 30 percent of staff injuries due to patient handling were linked to working with a bariatric patient, even though such patients constituted less than 10 percent of the facility’s patient population.”).

98. *Id.* (“In 2002, 25 percent of morbidly obese patients were treated for six or more co-morbid conditions, such as diabetes, lipedema, lymphedema, skin infections, joint disease, heart disease, incontinence and respiratory problems.”).

99. Joy Stephenson-Laws et al., *Hospitals: The Biggest Losers in the Health Care Debate*, 28:6 WESTLAW J. INS. COVERAGE 1, 1 (Nov. 17, 2017) (arguing that the obesity crisis will continue to challenge the finances of healthcare providers). Further, Obese patients have more frequent hospitalizations, use more prescription medications, and require more follow-up care than non-obese patients. *Id.* at 2.

that the odds of an ice storm near a hospital are one in one thousand. Then, imagine that the odds of a mass shooting near or at the hospital are also one in one-thousand. The odds of these two rare events taking place are then the result of multiplying the odds of each event occurring by the other (1000 times 1000). So, the odds of a mass shooting near or at the hospital during an ice storm are one in one-million.¹⁰⁰ Thus, the combined risk does not even seem to merit consideration by risk managers and stakeholders of the hospital.

But what if the odds of these two rare events occurring are related? Suppose a mass shooter is looking to cause the most destruction possible and waits until a deadly weather event to spread terror. Then, the odds of having these two rare events occur at the same time are not one in one-million because the risk of the deadly shooting is contingent upon the occurrence of the ice storm. To better manage these worrisome possibilities, healthcare risk assessors should look toward other fields, such as environmental law, which already use cumulative risk assessment.

C. *The Accelerators*

Accelerators are events within healthcare facilities that shift the standard expectations regarding patient care. They operate synergistically to increase and even enhance other risks and should therefore be a priority for cumulative risk assessments.

1. *Staffing Risks*

The United States faces a continuing shortage of nurses.¹⁰¹ Hospitals have responded by using temporary workers provided by outside agencies (though this is expensive and tends to result in lower quality care), creating internal systems for nurses to receive higher levels of compensation for working extra hours, increasing

100. Shere, *supra* note 68, at 467 (giving the same example using a hailstorm during the Super Bowl won by the Cleveland Browns to demonstrate the stacking effect).

101. Rebecca Grant, *The U.S. is Running Out of Nurses*, ATLANTIC (Feb. 3, 2016), <https://www.theatlantic.com/health/archive/2016/02/nursing-shortage/459741/> [<https://perma.cc/B5RY-QX9P>].

overall compensation, and investing in education and training for new nurses.¹⁰² However, gaps in staffing remain.¹⁰³

Gender discrimination and stereotyping are also unfortunately far too common within the healthcare workplace.¹⁰⁴ Pay and status differentials between men and women in healthcare occupations affect staff retention and morale.¹⁰⁵ The impact of the #MeToo movement on healthcare organizations is still unknown. Additionally, patients who experience sexual harassment from physicians sometimes file complaints with the controlling medical board or sue their doctors.¹⁰⁶

Similarly, racial discrimination among staff and between patients and staff is a continuing problem for healthcare organizations.¹⁰⁷ Racial discrimination in the workplace increases physician turnover and decreases physician morale.¹⁰⁸ Research also shows that the healthcare system systematically discriminates against

102. See Jessica H. May et al., *Hospitals' Responses to Nurse Staffing Shortages*, HEALTH AFF. 316–23 (June 26, 2006), <https://www.healthaffairs.org/doi/pdf/10.1377/hlthaff.25.w316>.

103. See Jilian Mincer, *Short on Staff: Nursing Crisis Strains U.S. Hospitals*, REUTERS (Oct. 20, 2017), <https://www.reuters.com/article/us-usa-healthcare-nursing/short-on-staff-nursing-crisis-strains-u-s-hospitals-idUSKBN1CP0BD> [<https://perma.cc/7M2M-CR3U>] (“The Bureau of Labor Statistics estimates there will be more than a million registered nurse openings by 2024, twice the rate seen in previous shortages.”); *The Doctor is Out: 4 Ways to Fill Staffing Gaps in Health Care*, HEALTHCARE BUS. & TECH. (Nov. 22, 2016), <http://www.healthcarebusinesstech.com/fill-staffing-gaps-healthcare/> [<https://perma.cc/EY2T-JN3Y>] (“The nation will likely have 61,700 to 94,700 fewer doctors than necessary by 2025.”).

104. See Constance Newman, *Time to Address Gender Discrimination and Inequality in the Health Workforce*, 12 HUM. RESOURCES HEALTH 25, 25 (2014).

105. See Lisa Ryan, *Gender Pay Gaps in Hospital Medicine*, HOSPITALIST (Feb. 2012), <https://www.the-hospitalist.org/hospitalist/article/125408/gender-pay-gaps-hospital-medicine> [<http://perma.cc/BRK6-E428>] (noting that a female physician left her job at a hospital after learning that a less-experienced male physician was earning \$10,000 more annually than she was earning, stating that “the job was no longer interesting”).

106. See, e.g., Carrie Teegardin et al., *License to Betray*, ATLANTA J.-CONST. (July 6, 2017), http://doctors.ajc.com/doctors_sex_abuse/?ecmp=doctorssexabuse_microsite_nav [<http://perma.cc/U2C9-DY5B>].

107. See, e.g., Michael O. Schroeder, *Racial Bias in Medicine Leads to Worse Care for Minorities*, U.S. NEWS & WORLD REP. (Feb. 11, 2016, 10:13 AM), <https://health.usnews.com/health-news/patient-advice/articles/2016-02-11/racial-bias-in-medicine-leads-to-worse-care-for-minorities> [<https://perma.cc/M68Z-QLCM>].

108. See Marcella Nunez-Smith et al., *Health Care Workplace Discrimination and Physician Turnover*, 101 J. NAT'L MED. ASS'N 1274, 1274 (2009).

patients of color due to structural bias.¹⁰⁹ And patients may discriminate against doctors as well, sometimes believing that they will receive better care from white doctors.¹¹⁰

Finally, staff may face workplace harassment and violence.¹¹¹ Given the physical and emotional nature of healthcare provider-patient relationships, the risk for harassment and violence is greater in the healthcare setting than in the average workplace.¹¹² For an extreme example, in 2017, a disgruntled former physician Henry Bello opened fire at Bronx-Lebanon Hospital in New York City, killing one and wounding six others before he shot himself.¹¹³ Patients are the largest perpetrators of violence against staff in the healthcare workplace.¹¹⁴ Family members of patients may also threaten or commit acts of violence against staff. In 2015, Stephen Pasceri—dissatisfied with cardiovascular surgeon Dr. Michael J. Davidson’s care of Pasceri’s mother—arrived at Brigham and Women’s Hospital in Boston and shot Dr. Davidson and then himself.¹¹⁵

2. Short-Term Mass Casualty Emergencies

Short-term mass casualty events—such as disease pandemics, natural disasters, gun violence, and terrorism—are the risks to healthcare organizations that often receive the most public

109. Ruqaiyah Yearby, *When is a Change Going to Come?: Separate and Unequal Treatment in Health Care Fifty Years after Title VI of the Civil Rights Act of 1964*, 67 SMU L. REV. 287, 293 (2014).

110. See Kimani Paul-Emile et al., *Dealing with Racist Patients*, 374 NEW ENG. J. MED. 708, 708 (2016).

111. See OCCUPATIONAL SAFETY & HEALTH ADMIN., *WORKPLACE VIOLENCE IN HEALTHCARE: UNDERSTANDING THE CHALLENGE 2* (2015) [hereinafter *WORKPLACE VIOLENCE*].

112. *Id.* at 1.

113. Ralph Ellis et al., *Doctor Fatally Shoots 1, Wounds 6 at NYC Hospital Before Killing Himself*, CNN (July 1, 2017, 10:41 AM), <http://www.cnn.com/2017/06/30/us/new-york-hospital-shooting/index.html> [<https://perma.cc/4CAV-HEUY>].

114. *WORKPLACE VIOLENCE*, *supra* note 111, at 2.

115. Felice J. Freyer et al., *Surgeon Slain, Gunman Found Dead in Day of Crisis at Brigham*, BOS. GLOBE (Jan. 20, 2015), <https://www.bostonglobe.com/metro/2015/01/20/boston-police-investigate-report-shooting-brigham-and-women/Jhig9z8LO8A5PH9Er4vTiP/story.html> [<https://perma.cc/L985-A5S2>].

attention.¹¹⁶ Though rare, catastrophic events can dwarf the impact of all other risks that a healthcare organization faces.¹¹⁷

The recent Ebola crisis in West Africa demonstrates the panic that can spread in the wake of a disease pandemic.¹¹⁸ While healthcare providers face risks associated with health workers returning from pandemics elsewhere,¹¹⁹ they also must plan for the likelihood of a future disease outbreak at home.¹²⁰ The sudden strain on resources, along with mass panic, can overwhelm providers.¹²¹

Increasingly, natural disasters are also causing healthcare organizations to struggle with sudden and unexpected influxes of patients.¹²² Even heavy winter storms force hospitals to release all patients who can be released in anticipation of low staff and

116. See, e.g., Rachel Bishop, *A&E Nurse Reveals Horror that Unfolded as Manchester Terror Attack Victims Rushed to Hospital*, MIRROR (May 24, 2017, 5:12 PM), <https://www.mirror.co.uk/news/uk-news/ae-nurse-reveals-horror-unfolded-10491290> [<https://perma.cc/22VU-9AYY>]; Helen Branswell, *A Severe Flu Season is Stretching Hospitals Thin. That is a Very Bad Omen*, STAT (Jan. 15, 2018), <https://www.statnews.com/2018/01/15/flu-hospital-pandemics/> [<https://perma.cc/5PCX-APM2>]; Ana B. Ibarra, *Hospitals' Best-Laid Plans Upended by Disaster*, KAISER HEALTH NEWS (Jan. 24, 2018), <https://khn.org/news/hospitals-best-laid-plans-upended-by-disaster/> [<https://perma.cc/FMV9-PEPG>].

117. See generally Mahshid Abir et al., *Effect of a Mass Casualty Incident: Clinical Outcomes and Hospital Charges for Casualty Patients Verses Concurrent Inpatients*, 19 ACAD. EMERGENCY MED. 280 (2012) (discussing how mass casualty incidents can negatively affect outcomes for other patients); Soumya Karlamangla, *As Health Workers Deal with Mass Shootings and Fires, More Hospitals are Looking to Help Them Cope*, L.A. TIMES (Jan. 2, 2018, 3:00 AM), <http://www.latimes.com/local/california/la-me-ln-code-comp-20180102-htmstory.html> [<https://perma.cc/6E48-ANVJ>].

118. See Marc Santora, *New Jersey Accepts Rights for People in Quarantine to End Ebola Suit*, N.Y. TIMES (July 27, 2017), <https://www.nytimes.com/2017/07/27/nyregion/new-jersey-accepts-rights-for-people-in-quarantine-to-end-ebola-suit.html> [<https://perma.cc/S38Y-NCSS>].

119. See, e.g., Joel Achenbach et al., *American Doctor Infected with Ebola Returns to U.S.*, WASH. POST (Aug. 2, 2014), https://www.washingtonpost.com/national/health-science/us-confirms-2-americans-with-ebola-coming-home-for-treatment/2014/08/01/c20a27cc-1995-11e4-9e3b-7f2f110c6265_story.html [<https://perma.cc/3CCV-NLWE>].

120. See generally WORLD HEALTH ORG., HOSPITAL PREPAREDNESS FOR EPIDEMICS (2014) (discussing how hospitals can prepare for epidemics).

121. See, e.g., Amanda MacMillan, *Hospitals Overwhelmed by Flu Patients are Treating Them in Tents*, TIME (Jan. 18, 2018), <http://time.com/5107984/hospitals-handling-burden-flu-patients/> [<https://perma.cc/WVV6-8XSR>].

122. See Ibarra, *supra* note 116.

weather-related accidents, and to find places to house necessary personnel during the storms.¹²³

Areas with greater poverty are typically hit the hardest by natural disasters.¹²⁴ Governmental and charitable assistance is critical in evacuating patients and getting providers up and running after storms, as vulnerable communities lack the resources to shore up their own healthcare institutions.¹²⁵ For example, in Puerto Rico, Hurricane Maria continues to disrupt healthcare months later.¹²⁶ The long-term loss of power, clean water, and useable roads has cost facilities the ability to properly care for patients and prevented patients from being able to reach these facilities.¹²⁷ Needs changed in the aftermath of the hurricane. Mold from damaged structures resulted in respiratory ailments, and people needed vaccinations for tetanus.¹²⁸ Doctors began fleeing the island because they had the means to do so, which resulted in staffing shortages.¹²⁹ This is an apt example of the synergistic reaction of one risk when it is exposed to accelerators. The accelerator (the hurricane) increases other risks (staffing risks), which in turn might worsen the effect of the accelerator risk.

There are also the economic losses from natural disasters. For example, Hurricane Harvey caused about \$460 million in losses

123. Lindsay Kalter, *Kalter: Hospitals Prepare for Foul Weather*, BOS. HERALD (Jan. 4, 2018), http://www.bostonherald.com/news/columnists/lindsay_kalter/2018/01/kalter_hospitals_prepare_for_foul_weather [<https://perma.cc/R5SB-TBTV>].

124. See Gabriela Meléndez Olivera, *Hurricane Maria Exposed the U.S.'s Long Neglect of Puerto Rico*, ACLU (Dec. 11, 2017, 9:00 AM), <https://www.aclu.org/blog/human-rights/hurricane-maria-exposed-uss-long-neglect-puerto-rico> [<https://perma.cc/KMK6-DWR2>].

125. See Gillian B. White, *A Long Road Home*, ATLANTIC (Aug. 3, 2015), <https://www.theatlantic.com/business/archive/2015/08/hurricane-katrina-sandy-disaster-recovery-/400244/> [<https://perma.cc/52Z7-KVDH>] (discussing how impoverished areas are hardest hit by natural disasters).

126. See Shanoor Seervai, *How Hurricane Maria Worsened Puerto Rico's Health Care Crisis*, COMMONWEALTH FUND (Dec. 18, 2017), <http://www.commonwealthfund.org/publications/features/2017/puerto-rico-health-care-crisis> [<https://perma.cc/765Z-CV89>].

127. Michael Joe Murphy, *Commentary: Puerto Rico Health Care under 'Unimaginable' Stress after Hurricane Maria*, ORLANDO SENTINEL (Dec. 19, 2017), <http://www.orlandosentinel.com/opinion/os-ed-puerto-rico-health-care-scramble-s-after-hurricane-interview-20171218-story.html> [<https://perma.cc/RNZ8-AVYD>].

128. *Id.*

129. See Olivera, *supra* note 124.

across ninety-two Texas hospitals.¹³⁰ Roughly \$380 million of those losses came from structural damages; another \$40 million came from “uncompensated care costs attributable to the storm and its aftermath”; and approximately \$48 million came from “business office closures, billing and claims disruption, delayed or unpaid insurance claims and more.”¹³¹ Not-for-profit hospitals sought reimbursement from the Federal Emergency Management Agency, but for-profit hospitals were left without this assistance.¹³²

Staff may also be impacted by natural disasters as they may lose homes and worry about family members while trying to work.¹³³ Increasing numbers of these events can result in mental health issues for hospital staff and administrators.¹³⁴ This is an example of a risk (poor staff mental health) that is increased as a result of another “accelerator” risk (a mass-casualty event), that can in turn enhance both the first risk (poor staff mental health) while increasing the dangers associated with the accelerator risk (poor patient care during the mass casualty event). Staff can even have their own health impacted directly by the disaster. For example, poor air quality from the recent California wildfires impacted both hospital staff and patients alike.¹³⁵

D. *Building Consensus*

Environmental regulators and stakeholders built a consensus around the need for cumulative risks assessments because while considering risks in isolation makes assessments easier, it does not accurately assess the risks faced by a population.¹³⁶ People in the real world may be exposed to multiple chemicals at the same time. They

130. Susannah Luthi, *Disaster Aid Coming Piecemeal to Hard-Hit Hospitals*, MODERN HEALTHCARE (Dec. 15, 2017), <http://www.modernhealthcare.com/article/20171215/NEWS/171219909> [<https://perma.cc/G7VE-4EXD>].

131. *Id.*

132. *Id.*

133. See Henry Thomas, *Hospitals Must be Mindful of their Obligations to Employees During Natural Disasters*, CAL. HEALTHCARE NEWS (Dec. 5, 2017), <http://www.cahcnews.com/articles/12-2017/ca-hthomas-1217.php> [<https://perma.cc/AP25-TZWK>].

134. Karlamangla, *supra* note 117.

135. Soumya Karlamangla, *Southern California's Hospitals Prepare for the Worst as Embers Ignite Throughout the Region*, L.A. TIMES (Dec. 8, 2017, 11:20 AM), <http://www.latimes.com/local/california/la-me-wildfires-air-quality-hospitals-2017-12-08-story.html> [perma.cc/8G6D-94P4].

136. See, e.g., RISK ASSESSMENT FORUM, *supra* note 15, at 30.

may also be exposed to numerous non-chemical stressors such as poverty, aging parents, and many other stressors that change the impact that those chemicals would otherwise have on their bodies.¹³⁷

Similarly, hospital patients and staff are exposed to both stressors inherent in their roles at the hospital and to stressors related to their lives outside the hospital. Yet the risk assessments performed by healthcare organizations fail to evaluate the full picture when they address only some of the risks and only in isolation. Providers need to better understand what non-economic risks they and their patients, staff, and visitors face. They also need to know if a sub-population is particularly vulnerable to those risks.

IV. MANAGING CUMULATIVE RISKS IN HEALTH ORGANIZATIONS

The three phases of a cumulative risk assessment set forth in the EPA's Framework—“(1) planning, scoping, and problem formulation, (2) analysis, and (3) risk characterization”¹³⁸—can also be applied by healthcare organizations. First, risk managers and stakeholders should address the goals and scope of the assessment. Given that cumulative risk assessments should not merely be laundry lists of every possible risk faced by everyone who sets foot in a healthcare facility, the key part of this first step is to decide which piece of the puzzle to analyze.¹³⁹ Is a particular risk assessment intended to address all risks faced by emergency room patients, with a focus on a particular accelerator such as short-term mass casualty emergencies? Or is it to focus on a particular negative impact the group wants to investigate, such as high blood pressure among certain patients under care, or long wait times for patients with certain injuries/conditions? Or should the focus be on a particularly vulnerable population? The analysis plan will set out what data is needed and how to obtain it.¹⁴⁰ Patient and/or staff questionnaires

137. Ari S. Lewis et al., *Non-Chemical Stressors and Cumulative Risk Assessment: An Overview of Current Initiatives and Potential Air Pollutant Interactions*, 8 INT. J. ENVTL. RES. PUB. HEALTH 2020–21 (2011), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3138011/> [<https://perma.cc/8PHS-L7BD>].

138. See RISK ASSESSMENT FORUM, *supra* note 15, at xviii.

139. See *id.* at 14 (discussing the planning and scoping phase of a cumulative risk assessment).

140. These questions show that during this phase, a decision should be made about whether to use stressor-based (“bottom-up”) methods to ask: “what health effects are related to a defined set of stressors” or effects-based (“top-down”) methods to ask “retrospectively . . . which stressors explain observed or hypothesized

may be an important component of data gathering, as will information on the population in question, which may be obtained from state and local public health agencies.

In the analysis phase of the assessment, the main work is evaluating the interactions between and among the stressors identified in the first phase and then using that evaluation to predict risks for the population and any relevant sub-populations.¹⁴¹ Information uncertainties and missing data will mean that this stage may include quantitative or qualitative analysis, or some mixture of both. Even anecdotal evidence may support action by a healthcare organization to change policies and procedures.¹⁴² The result of this phase should be gathering information necessary to determine where there are red flags indicating potential high risks. When determining interactions, special attention must be paid to accelerators and whether and how they operate synergistically to increase risk.

Last, in the risk characterization phase, the risks identified in the analysis phase are placed in context by comparing them to other risks that require resources at the organization and determining whether the quantitative and qualitative data analyzed are sufficient to conclude that resources should be used to address a particular risk.¹⁴³ The organization will have to make choices that include whether to prioritize risks based on likelihood of occurrence or potential impact assuming occurrence. All employees of a healthcare organization must participate in managing and mitigating risks.¹⁴⁴

health effects in a population or community.” Sexton, *supra* note 18, at 379.

141. See RISK ASSESSMENT FORUM, *supra* note 15, at 34 (discussing the analysis phase of a cumulative risk assessment).

142. Cf. Amy Donahue & Robert Tuohy, *Lessons We Don't Learn: A Study of the Lessons of Disasters, Why We Repeat Them, and How We Can Learn Them*, J. NPS CTR. FOR HOMELAND DEF. & SEC. (July 2006), <https://www.hsaj.org/articles/167> [<https://perma.cc/T4XL-MMDW>] (citing many instances of anecdotal evidence to illustrate the need to learn from specific experiences, for example, the Columbine Massacre and the immediate nationwide changes to S.W.A.T. protocol).

143. See RISK ASSESSMENT FORUM, *supra* note 15, at 59 (discussing the last phase of cumulative risk assessment, risk characterization).

144. Dorfschmid & Forman, *supra* note 67, at 20 (“Addressing compliance risks is not solely the responsibility of the compliance officer.”).

V. CONCLUSION

Current risk assessments by healthcare organizations are typically deficient because they fail to consider cumulative risk. The environmental law and regulatory community has reached consensus on the importance of assessing cumulative risk for public health. Yet, healthcare providers continue to assess risks in isolation. The time has come to focus on cumulative risks to health, even if there are uncertainties based on the unpredictability of human behavior and lack of data. Building a consensus on the need for cumulative risk assessment by healthcare organizations will show the need for additional tools and data. Even if uncertainties remain, evaluating cumulative risk and understanding how individual risks may interact with each other will lead to safer conditions for employees and patients alike.

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