

Bets Against the Odds in a Pandemic: Which of three Coronavirus bets are you willing to gamble on?

David D. Woods

woods.2@osu.edu

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Strategic Bets

The different reactions and claims in the US about responding to the Covid-19 outbreaks rolling across the country and the world boil down to *three bets*. We hear different people saying, often loudly, one of these is the preferred bet.

Covid-19 outbreaks present novel, uncertain, and changing situation to policy makers and the public. Our understanding of the threats from Covid-19 in terms of transmission, prevalence, disease progression, morbidity & mortality continues to shift. For example, virus mutations over time can affect transmission, disease risks become evident, and critical care medicine continues to evolve better care protocols for those who are seriously ill.¹

The uncertainty means that different strategic responses to the pandemic are bets about the future. We do not know how the virus will change, what the ultimate fatality rate will be, what treatments will emerge, how immunity will build in the population, or how vaccine development will provide a defense against the virus. There are three bets circulating in the US:

1. The *act early, act aggressively bet* – the benchmark from past epidemics is acting early to break transmissions. The windows of opportunity to break transmission occur early in an outbreak. The bet is that aggressive actions in these windows, despite the disruptions that accompany the interventions, are effective to get outbreaks under control. Since larger and continuing outbreaks disrupt society, early aggressive responses are expected to reduce the human toll, reduce the total economic impact in the long run, and speed economic recovery once the infectious disease comes under control.

2. The *density bet* – risk and impact of an outbreak is strongly associated with aspects of density, so act strongly where density is high or to reduce dense encounters in time and

¹ For examples: change in transmissibility see Korber et al. (2020). Spike mutation pipeline reveals the emergence of a more transmissible form of SARS-CoV-2. <https://www.biorxiv.org/content/10.1101/2020.04.29.069054v1.full.pdf> ; for a change in understanding of disease mechanisms as a vascular threat see Varga et al. (2020). Endothelial cell infection and endotheliitis in COVID-19. *Lancet*, 395, 10234, 1417-1418, [https://doi.org/10.1016/S0140-6736\(20\)30937-5](https://doi.org/10.1016/S0140-6736(20)30937-5) .

space. There is little or no need to act strongly elsewhere where density is relatively low given the costs of aggressive actions to stem outbreaks. Density refers to any factors that put people close together in time or space in ways that increase the risk of transmission spikes. The expression begins, 'but we're not New York, so we don't need to do ____'.

3. The *natural course bet* – all we can do given uncertainty and offsetting costs is let the pandemic run its course. When people make this bet they fall into one of two sub-varieties:

- *mitigate risks for the vulnerable bet* – There is little we can do, or our knowledge about which interventions are cost-effective is very limited. Thus, our efforts should go into mitigating the worst of the natural course of the epidemic on the most vulnerable, on essential service workers, and on health care personnel.
- *"so what" or bolsonaro bet* – we can only *suffer the casualties* since the natural course is unavoidable or will prove to be much less harmful than people think (named for the quote from the Brazilian president on April 28th, 2020). The callous disregard for human life in this bet says, in effect: minimize any impact on me since I bet my risk is low.

How are these bets against the odds?

How should one act when they are in the middle of a developing crisis given the uncertainty about the future course of threats, in this case from the infectious disease? Actions now are bets about what the analyses will show in the future when the end result is known. Plus, when we are in the crisis, no one can know the actual odds for different bets; these are derived afterwards when the crisis is resolved and great effort goes into dissecting the impact of different strategies and tactics. Thus, every one is making a bet "against the odds."

In the case of this crisis, the difficulty of making a bet is exacerbated by the novelty of the infectious disease. This means knowledge about the threats and the ways to resolve those threats are partial and spread across different roles, activities, and perspectives. The knowledge needed will emerge and zig/zag over time with false dawns, promising paths that lead to dead ends, and paths to effectively counter threats will open up from unexpected sources.

The difficulty and uncertainty of picking a bet is amplified by the noise generated by different sources with different stances, different experiences, different perspectives. Plus, in this time period we experience data sources being hijacked to push unrelated agendas and active disinformation campaigns.

Uncertainty, novelty, and noise combine to make the strategic and tactical options bets against the odds, odds that cannot be estimated sufficiently. What strategic approach should guide and coordinate a jurisdiction's response to Covid-19?

Despite the uncertainty and multiple risks, each jurisdiction, and each of us as actors and stakeholders in the pandemic, have to commit to a course of action. To delay or fail to commit is in fact making a commitment to the third *natural course bet*.

Based on studies of emergency and critical care medicine, fire fighting, disaster response, military operations, we know quite a bit about how to act as crises grow over time despite high and irreducible uncertainty relative to risks. We will return to these results at the end of the paper.²

Pooled Bets

Interestingly, whatever bet a person, a family, a community, a region, a state, or nation makes, that bet is pooled with the bets of other people, communities, jurisdictions. The pooling can wash out or diminish one unit's bet. For example, a jurisdiction may act aggressively to break transmissions with some form of shelter in place policy. But if a large portion of families and individuals in that jurisdiction want to place a different bet, compliance with the shelter and shutdown directives will drop. This reduces the effectiveness of this version of *act early, act aggressively* bet at the jurisdiction level. Or a family may want to follow through on aggressive preventative steps with distancing, wearing masks on public outings, minimal trips for supplies. But the effectiveness of these behaviors at risk reduction may be washed out if most of the local community makes different bets, e.g., disregarding or disapproving of recommended measures to break or minimize transmission paths.

The effectiveness of any strategic bet depends on how other neighboring units' bets align or conflict. Alignment across bets reinforces the potential for effective follow through on actions; fragmented bets undermines any coherent response. Fragmentation undermines the impact of early aggressive tactics and tends to default to the *natural course bet*. Fragmentation undermines effective mitigation actions to reduce impact on vulnerable populations, and places additional burdens and costs on the medical community treating the seriously ill.

In this pandemic, adopting a strategic path is made more difficult because of the time lags in transmission, disease emergence, and disease progression. When the threats and responses are measured minimally in weeks, sustaining some bets becomes especially burdensome and follow through breaks down.

The US is doing a haphazard contest on which of these three strategic paths is a sound bet. The noise resounding across the country also effects how the bets are pooled across people and levels of society. In some areas of the country, we see pooling that reinforces a single strategic bet; in different areas fragmentation undermines any coherent direction. It is as if there is a series of poorly designed experiments underway as different areas pick different

² See Klein, G. (1998). *Sources of Power*; Cook, R. I. (1998) *How Complex Systems Fail*, <https://web.mit.edu/2.75/resources/random/How%20Complex%20Systems%20Fail.pdf> and <https://www.youtube.com/watch?v=2S0k12uZR14> ; Grote, G. (2004). Uncertainty management at the core of system design. *Annual Reviews in Control* 28(2):267-274. DOI: [10.1016/j.arcontrol.2004.03.001](https://doi.org/10.1016/j.arcontrol.2004.03.001)

bets or try different mixes of the three, given the pressure from voices yelling loudly for their preferred bet. We'll see what happens as the situation evolves, especially since other parts of the world have made a consistent choice of one or another strategic bet which can serve as comparisons.

The Three Bets

act early, act aggressively bet

The *act early, act aggressively bet* is based on learning from past epidemics, such as SARS, Ebola, Zika, and others.³ Within this strategy there are debates about what are the most effective aggressive actions relative to collateral costs and the proper timing of different interventions. Part of this bet is the claim that infectious disease outbreaks have *windows of opportune action*. By acting in the right way at the right time, the size of negative effects across all dimensions are reduced in the long run. At least, that has been a good bet in past outbreaks.

One example of developing action capabilities matched to windows of opportunity is jurisdictions who were able to develop extensive contact tracing mechanisms to contain or block outbreaks. The state of Kerala in India, Vietnam, and Germany are three different jurisdictions that were able to stand up the necessary functions for effective contact tracing within windows of opportune action. Interestingly, the capability had little to do with sophisticated 21st century medical practice nor did it require massive financial expenditures. The capability required a coordinated response empowering and amplifying actions at the local network of health care delivery, coordinated with activities by regional and national/ state organizations. The coordination of activity across communities and levels of society are needed for this intervention to work. This level of coordination depends on several factors such as trust and commitment to common goals.

Given lessons from past epidemics, there should be little debate about a subset of potential countermeasures. For example, it should be non-controversial to restrict large gatherings since they act as transmission vectors that lead to rapid disease spikes. This has occurred during this pandemic and in the 1918-1919 pandemic.⁴ Simulation models show the risk of transmission grows rapidly with the size of the gathering especially as prevalence of the virus

³ Laurie Garrett, who wrote on the lessons from control of the ebola outbreak, provides an accessible syntheses in *Ebola: Story of an Outbreak* and *The Coming Plague: Newly Emerging Diseases in a World Out of Balance*.

⁴ This occurred in the South Korean experience <https://graphics.reuters.com/CHINA-HEALTH-SOUTHKOREA-CLUSTERS/0100B5G33SB/index.html> and in the US experience. <https://www.businessinsider.com/coronavirus-super-spreader-events-reveal-gatherings-to-avoid-2020-5> and <https://www.nytimes.com/2020/03/30/us/coronavirus-funeral-albany-georgia.html>

grows, and studies of the 1918-1919 pandemic show fatalities were lowest for jurisdictions which acted aggressively early.⁵

Acting early and aggressively is needed to prevent overwhelming the medical capacity to treat those seriously ill from Covid-19 and for non-Covid illnesses and injuries. An overwhelmed medical system in a jurisdiction increases unnecessary deaths significantly. The point is there are measures that can be taken to reduce the misery, morbidity, and mortality.

However, early aggressive actions exacerbate the disruptions of normal societal activities produced by the epidemic in the short run. The costs of the disruption also weigh heavily on the population and lead to growing pressures to cut back or stop the aggressive interventions.

Nevertheless, studies of the 1918-1919 pandemic also show economic recovery was stronger and faster for the jurisdictions which acted faster to get the outbreak under control (ibid). The best course for economic goals and for public health goals were the same in that pandemic.

The *act early, act aggressively bet* also claims that economic and health effects of infectious disease outbreaks are interconnected and cannot be separated. Economic disruptions continue as long as transmissions can spike, produce serious health consequences for the infected, and threaten health system overload.

But the human world is very different from 1918; the virus is very different from influenza; the health care capabilities of the world are very different. Perhaps the story of 2020 will be different as well? Perhaps the ultimate fatality rate will turn out much lower than current estimates or perhaps treatment breakthroughs will dramatically reduce the death toll. Perhaps the virus will mutate into less threatening and disruptive form. While we are in the epidemic, this bet still may be against the odds.

density bet

The *density bet* is based on past epidemics where the biggest disease outbreaks and fatalities were on people in dense places/events. This stands out about the 1918-1919 pandemic. For example, parades celebrating the end of WW I were held in Philadelphia. These became major transmission vectors. Disease fatalities were high in camps where soldiers were massed.⁵ There are factors that correlate with density so that population segments who are most vulnerable physiologically to the virus tend to live, work, and travel in close proximity, leading to higher fatalities. This can be seen in New York City, for example,

⁵ Correia, Sergio and Luck, Stephan and Verner, Emil, Pandemics Depress the Economy, Public Health Interventions Do Not: Evidence from the 1918 Flu (June 5, 2020). Available at SSRN: <https://ssrn.com/abstract=3561560> or <http://dx.doi.org/10.2139/ssrn.3561560> . Jester, B., Uyeki, T. and Jernigan, D. (2018). Readiness for Responding to a Severe Pandemic 100 Years After 1918. *American Journal of Epidemiology*, 187, (12), DOI: 10.1093/aje/kwy165 . See papers from Weitz group at Georgia Tech <https://ecothery.biosci.gatech.edu/publications> .

contrasting the experience of workers in the Bronx who had to travel to perform essential services with workers in parts of Manhattan who could continue their jobs from home.

This leads to expressions of the form: its okay for NY, SF, Atlanta and other densely populated areas to take aggressive but highly disruptive actions, but I do not live in the density zones (or can get away from those easily) so just take those highly disruptive steps over there, not around me. One can see several US states as partly making this density bet.

What are the odds on this bet? If the virus was a Las Vegas casino, it's probably not a great bet for a player. Why? Simple – there are plenty of ways people intersect to create density for a enough time to increase the risk of transmission spikes. People gather together with many points of congregation throughout lower density population areas in the country. People gather for entertainment, religion, charity outreach, work, special events, and these gatherings all come with high potential for transmission spikes. This has occurred, for example, in the meat packing plants located in lower population jurisdictions. Plus, low density areas also have populations with factors that increase risk of mortality from the disease – poor health, limited access to medical care, extensive prevalence of co-morbidities. There is no a priori reason why outbreaks can't spread creating hotspots in non-urban or smaller cities. These outbreaks may get less publicity or not look as scary to others as the scale of the outbreak in NYC.

The mitigation of risks to vulnerable groups is part of this bet, i.e., there are effective measures that can be taken to protect vulnerable groups. But we already see evidence in several parts of the world that care homes have not been well protected despite authorities intent. Vulnerable populations continue to bear a disproportionate share of the disease's health effects. So far, both parts of the density strategy look like bets quite against the odds. But we are still in the first wave – maybe re-emergence will not happen; maybe a second wave won't occur; maybe the virus will not spread to smaller cities and lower population areas since travel has been reduced so much.

natural course bet

For some people, the legitimate novelty and uncertainty associated with this epidemic means we don't/can't know enough to judge what actions are more or less effective. Importantly, they point out the uncertainty means that any partial emerging information on what jurisdictions are doing better/worse could be due to 'chance' and not the strategy/tactics being deployed. By chance they mean we can't know the facts about what factors mattered and what tactics work well and what work poorly until post-pandemic analyses are done and these will take years to carry out.

The benign version of this bet then asserts the best we can do is mitigate the worst of the natural course of the epidemic until effective treatments arrive or some means to build immunity is available at national population scales. One should treat hot spots, mitigate the

natural spread, expand hospital capabilities, but in the end the pandemic *just has to run its course*.

However, the *natural course bet* ultimately is passive in the face of the crisis. And this passivity defies the first principle from naturalistic decision making in a crisis: *be decisive, while respecting the uncertainty*. To fail to act decisively is to fail – see studies of fire ground commanders, ER doctors, mass casualty response, and on and on.⁵ Uncertainty about what factors matter and what tactics work temper when and how to be decisive, but in the end some one has to take partial uncertain information and past lessons and make a *commitment to a course of action*, recruiting others to support that course of action.

In the case of this epidemic, sustained commitment is particularly difficult because of the time delays in the feedback loops. Another difficulty is that making a commitment to a course of action comes with the risk of getting stuck and being unable to revise assessment and replan as new evidence, events and changes occur.

Passivity in a crisis means this version of the *natural course bet* is not actually benign. It is unstable and will shift to a more natural resting place, either as the *density bet* because there is significant investment in effective mitigation, or as the *'so what' bet* as passivity degenerates into *just suffer the casualties*. This shift also appears as mitigation steps lose energy and support, become fragmented, and effectiveness drops. The instability of the *'benign' natural course bet* means it is a bet against the odds.

"so what" bet

The bolsonaro or *"so what"* bet is different from the others because it is a break down in collaboration and reinforces widespread selfish behavior. The assumption is that "walls" can be built and I can hide from the storm behind those walls with little impact on me. This behavior is observed in past epidemics, but the lessons from the past point in the opposite direction. When analyzed after the fact, solidarity, coordination and cooperation build better responses and results (well, less bad results), as in the example of jurisdictions who stood up effective contact tracing processes.

Equity issues go out the window with *"so what"* bet as some segments make all the sacrifices while others coast. Front line clinicians are left exposed; essential service workers seriously affected; while the privileged are able to shelter (e.g., some white collar segments are able to work from home with secure incomes). Those who think they are removed from the risks then complain about the negative reverberating effects which inevitably impact their bubble.

The difficulty is *the bolsonaro* maximizes the length and size of the outbreak. This means the bet is that the *natural course of the epidemic* will not be that long or that bad in the end. As a result, voices that assert the natural course of the epidemic is not really a threat tend to proliferate and get amplified. These voices can assert a variety of themes: the fatality rate will turn out to be much lower than expected since the virus has already infected many people

with no or mild disease, illnesses really are due to other causes (the 5G conspiracy fantasy), or the only very ill people die from the disease and these would have died soon anyway. Whichever version is asserted, there is a common thread: on examination, what is offered as evidence for this position turns out to be non-existent – it's just a hope. And Hope isn't a plan.

Is the the “*so what*” bet a psychological coping mechanism for some? The metro NYC numbers hit levels that are really scary. One way to cope psychologically with the news about the disaster there is through distancing – my circumstances here are remote from what is going on there. Since where I live is not like NYC, therefore I am not at risk. And of course this is abetted by the media/political campaigns to “other” urban areas as separate from less dense parts of the US. Perhaps denying the threat is a way to cope with dissonance.

The “*so what*” bet claims, when the pandemic is over, the interventions will have cost much more than the benefits in Covid-19 health outcomes. But this claim is making a bigger bet: (a) the passivity, pessimism, selfishness, and fragmentation the *so what bet* endorses/produces will not lead to a significant increase in the misery, morbidity, mortality of the epidemics. (b) the *so what bet* will not extend the duration of the pandemic and its consequences over time. This is a bet against the odds based on what we have learned from past infectious disease outbreaks.

How the three bets interact

While the *density bet* is a real possibility given evidence from past epidemics, it easily can overlap or turn into the *bolsonaro* undermining the ability to act effectively in the areas needing interventions. If solidarity breaks down, it's hard to stop it spreading everywhere which will undermine effective responses anywhere.

Act early, act aggressively requires efforts to build and sustain solidarity across diverse aspects of society. This works best if the tools are available to surveil prevalence and target the aggressive efforts to the windows for opportune action. This minimizes the size and spread of the negative effects of acting to block transmission. If the only tools available are crude and/or deployed late, then the result will be wider disruptions lasting longer to less effect.

This produces a backlash to move to the full *bolsonaro* as the response. This backlash will build to some degree no matter what – adaptive systems thinking predicts it (as do studies of responses to past epidemics). Some may try to cushion the selfishness and callousness of this bet by arguing for the *density bet* – but this is generally done only by people who think themselves at a distance from the disease risks. The current situation in the US looks like all three bets are playing out in an uneasy mix.

Acting Under Uncertainty: Hedging Bets

The three bets are three strategies for action in the face of uncertainty and risk in this pandemic. As people argue for the bet they prefer, they often refer to the eventual outcome when the crisis has receded and analyses are complete: “my preferred bet will be proven justified when all of the information about outcome is available far down the road.” In other words, they think they can beat the odds and pick the one bet that will prove to be the correct one. When we are in the middle of the evolving crisis, all of the bets can be wrong when evaluated later calmly with time, resources, and hindsight.

The research on acting in the face of uncertainty and risk tells a different story. This research asks: what is a good process to follow when uncertainty is high? The findings on naturalistic decision making and resilient performance in a deteriorating situation or developing crisis focus on tactics to *hedge* one’s bets. Bet hedging respects how uncertainty is inherent when one has to act in the face of risk. To not act is to fail, yet to act exposes the actor to judgement after-the-fact. Well-resourced analyses, with access to much wider sets of data, under no time pressure, with knowledge of outcome, can find flaws in whatever path is taken. All action paths have too much chance of being wrong in ways that risk harm on some dimension for some stakeholders. In fact, there are many risks and goal conflicts across different stakeholders so all paths reduce some risks for some parties, while coming closer to other risks for other stakeholders. The difficulty is time pressure - the situation deteriorates and disturbances grow as time elapses in the search for diagnostic clarity. To not seek a better understanding of the situation is poor process, but to delay corrective interventions is also poor process.⁶

⁶ see Klein, 1998; Cook, 1998. Perry, S. J. & Wears, R. L. (2011). Large-scale coordination of work coping with complex chaos within healthcare, <https://doi.org/10.4324/9780203847985>. Woods, et al. (2010). *Behind Human Error (2nd Edition)*. Ashgate, Aldershot, UK. Chapter 8 of Woods, D.D. and Hollnagel, E. (2006). *Joint Cognitive Systems: Patterns in Cognitive Systems Engineering*. For bet hedging in biological systems (like viruses) see Beaumont HJ, Gallie J, Kost C, Ferguson GC, Rainey PB (2009) Experimental evolution of bet hedging. *Nature* 462(5), 90-93. <https://doi.org/10.1038/nature08504>

So what should one do? Hedge, but be Decisive, Synchronize across roles and levels, while remaining ready to Revise as change continues.⁷

(1) Hedging means taking steps while holding open or creating opportunities to change assessments, interactions, and course. For example, following recognizing an anomaly, early potentially corrective steps should be tentative, the impact of the steps should be diagnostic, and the actions easily modified as more information arrives. Hedges involve abilities to:

- Anticipate bottlenecks ahead to reduce the risk of decompensation.
- Build a readiness to respond as new demands arise and interact.

The goal is to avoid situations where cascading demands threaten to overwhelm response capabilities.

(2) Decisiveness refers to the need to take partial uncertain information and past lessons and make a *commitment to a course of action*, recruiting others to support that course of action. However uncertainty about what factors matter and what tactics work temper when and how to be decisive. There are constraints on acting decisively:

- Manage side effects of taking actions given interdependencies; this entails coordination with units who are responsible for these interconnected systems, functions, and goals.
- Actions are significant moves re-positioning system's operation in its underlying multi-dimensional trade space. The moves in the trade space value responsiveness is over efficiency of resource utilization, and the moves build new forms of coordination as standard/routines ways of operating are likely to be too slow and stale given the pace of events.
- Decisive actions change what goal are sacrificed and what goals are prioritized; thus, actions require significant shifts in attention and effort to manage and adjust how goals conflict.

(3) Synchronization across roles and levels is needed because no one role can do enough by themselves to handle all of the reverberations as the situation deteriorates. Roles need to adapt to help other roles at risk of being overwhelmed by cascading effects. Constructive actions by any single unit need to be supported and amplified by synchronized responses across other roles and levels.

- Coordinated activity depends on polycentrism, initiative, and reciprocity in work on adaptive systems.

⁷ Woods, D.D. (2019). Essentials of Resilience, Revisited. In M. Ruth and S. G. Reisemann (Eds.), *Handbook on Resilience of Socio-Technical Systems*, pp. 52-65. Chapter 8 of Woods and Hollnagel, 2006. Chuang, S., Chang, K.-S., Woods, D. D., Chen, H.-C., Reynolds, M., and Chien, D.-K. (2019). Beyond surge: Coping with mass burn casualty in the closest hospital to the Formosa Fun Coast Dust Explosion, *Burns*, 45, 964-973. Woods, D. D. (2006). Essential Characteristics of Resilience for Organizations. In E. Hollnagel, D.D. Woods and N. Leveson, eds., *Resilience Engineering: Concepts and Precepts*, pp. 21-34. Ostrom E. (2012). Polycentric systems: multilevel governance involving a diversity of organizations. In E. Brousseau et al., eds. *Global environmental commons: analytical and political challenges in building governance mechanisms*, p. 105-25. Klein, G., Feltovich, P., Bradshaw, J. M. and Woods, D. D. (2005). Common Ground and Coordination in Joint Activity. In W. Rouse and K. Boff (Ed.). *Organizational Simulation*, pp. 139-178.

- Reciprocity across roles is essential. Reciprocity means all roles will adapt their actions, efforts, goals, and risks in order to assist other roles in the expectation that others will adapt to provide assistance when events threaten to overwhelm their capacity to keep up with increasing demands. Reciprocity is built prior to the onset of critical events.

(4) Hedges, decisive commitment to a course of action, synchronization across roles all require a continuing Readiness to Revise assessments, relationships, courses of action, models, goals, and priorities. Making a commitment to a course of action comes with the risk of getting stuck and being unable to revise assessment and replan as new evidence, events and changes occur.

- Build and sustain adaptive capacities so systems are *poised to adapt* as new information, events, or developments occur.

Note that none of the bets, as such, carry out the these lessons on acting in the face of uncertainty. The third bet is too passive, too pessimistic, too callous. But effective execution of either of the first two bets depends on heeding the lessons above.

The first bet is best positioned to follow these lessons, but follow through depends critically on timing, coordination, and solidarity. When those break down, the short term costs of the first bet appear too high. This leads jurisdictions and people to defect from common purpose – reciprocity declines and pessimism grows. If the second bet is going to build and sustain processes to protect vulnerable groups, following the lessons above is essential.

The experiences in the pandemic so far reveal that follow through can be very difficult in many areas. Poor follow through leads to inequities where some groups bear high risks and costs. Inequities threaten fragmentation and declining ability to execute and sustain the processes needed to mitigate risk due to density effects.

Will We be Proud of Our Bets When the Human Toll is Counted?

Three bets, mixed up and fragmented across the US, in a story still unfolding. We'll see what happens. When you make your bet or decide to pool your bet with others, think about how you will feel when the pandemic has played out and society has reconfigured. Analyses will show which bets were good and which poor. Poor bets will be measured in excessive, unnecessary deaths. Will we be proud of ourselves and the bets we made when the final story is written? When embarrassed by unnecessary costs from poor bets, will we all conspire to suppress remembrances and bury the lessons of the current crisis in after-the-fact analyses only for specialists and historians?