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TECHNICAL REPORT

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TITLE: Foodborne disease and public health: a different perspective.

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ABSTRACT: Recently, the CDC has published an updated estimate of foodborne disease in the United States. The CDC assessment is critically reviewed and reorganized to portray the risks involved in units of public health cost. The five most important pathogens are: 1) Norwalk-like viruses; 2) *Salmonella*; 3) *Listeria*; 4) *Toxoplasma*; and 5) *Campylobacter*. The CDC report emphasizes the current safety of the US food supply, but also suggests more attention needs to be paid to food handler hygiene, home preparation and increasing consumption of uncooked produce.

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4) LISTERIA 5) NORWALK 6) CAMPYLOBACTER
7) TOXOPLASMA

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Introduction

Recently CDC has published a new estimate of foodborne disease in the United States, based loosely on FoodNet, PulseNet and other active reporting sources (Mead, Slutsker et al. 1999). Using reported cases and morbidities, the authors applied broad speculation as to under-reporting factors and extensions to the general population. The resulting *ad hoc* analysis suggests 76 million annual illnesses (mostly 1-2 day duration diarrheal episodes) with 325,000 resulting hospitalizations and 5,000 deaths. Of this public health load, the authors conjectured 80% of the illness were due to as yet unidentified etiological agents.

Although the analysis is highly subjective with an element of '*deus ex machina*' with regard to unknown etiological agents, this paper does represent a definite improvement in honesty in this type of study. The authors clearly lay out their assumptions and rationale for each value reported.

Since, as the Spanish say, '*aunque la mona se vista de seda, mona se queda*' ('a monkey dressed in silk is still a monkey'), let us leave the unsubstantiated 80% due to unknown causes behind and concentrate on the 20% of illness assigned to known biological agents.

There are approximately 266 million Americans, so an incidence of 14 million illnesses per year corresponds to one foodborne illness per 20 Americans per year, a believable number. This also corresponds to one illness per about 20,000 meals eaten per year, also a credible number. This is also the level of safety expected from traditional food safety practices. A bout of diarrhea once in 20,000 meals seems an acceptable risk, given that one in 28,500 Americans die from lightning strikes.

This CDC study makes it very clear that the US food supply is remarkably safe. Why then such concern for food safety in the press and politics? Well, there's 'lies, damned lies and statistics.' CDC, FDA, USDA, news reporters and even food safety consultants like myself benefit by exaggerating the situation. By concentrating on the large numbers involved, it makes the problem appear large. When the numbers are examined per person (1 mild foodborne illness per 20 years) or per eating occasion (1 mild illness per 20,000 meals), the problem appears in its proper proportions.

The CDC even admits in its assessment that two-thirds of the total disease resulting from these etiological agents are not even foodborne, but instead are transferred by water, person-person contact or other means. Thus even a miraculous improvement in food safety could theoretically only reduce total morbidity by 35% at the most. It's important to keep all of this in perspective, especially when allocating our public health resources.

How then should we direct our public health policy?

Using CDC's numbers of total foodborne cases estimated, the five leading causes of disease are:

1. Norwalk-like viruses (9 M cases/yr).
2. *Campylobacter* (2 M cases/yr).
3. *Salmonella* (non-typhi) (1.3 M cases/yr).
4. *Clostridium perfringens* (0.25 M cases/yr).
5. *Giardia lamblia* (0.2 M cases/yr).

This is a break from previous studies, as viruses are finally included and placed at the top of the list. It also reflects the increasing problems with our water supplies and parasites.

Unfortunately, this simple-minded listing of agents in order of cases generated does not properly reflect the true cost to society of the organisms involved. A mild bout of diarrhea is not commensurate with a fatal illness or even hospitalization.

When the CDC data is weighted by 'human cost' (viz., days of life lost), the importance of certain pathogens is markedly increased. Using the simple approximation that a human life is worth 42 years, on the average, a hospitalization costs 14 days and a mild illness costs 2 days, the top five etiological agents in decreasing order are:

1. Norwalk-like viruses (20.5 M-days/yr).
2. *Salmonella* (non-*typhi*) (11.3 M-day/yr).
3. *Listeria monocytogenes* (7.5 M-days/yr).
4. *Toxoplasma gondii* (5.9 M-days/yr).
5. *Campylobacter* (5.6 M-days/yr).

The next nearest agent (*E. coli* O157:H7) is below 1 M-days/yr, so these five 'bad bugs' are well separated from the others. Interestingly, when the CDC under-reporting factors are changed markedly to conform to more disease-dependent values, the same five pathogens still top the list in the same order, with about the same costs. Therefore this classification is very robust to assumptions involved.

What is the significance of this new ranking?

First, the importance of viruses and parasites strongly emphasizes the importance of food handler hygiene and health. (Maybe there was a reason for all those public health inspections, after all!) The alarming incidence of nosocomial infections in the medical field demonstrates that there is no simple answer to this problem, either in hand- or nail-washing techniques or in the use of gloves and sanitizers. In view of this, it is remarkable that FDA has just ruled that mandatory wearing of gloves is not yet warranted in food service.

Secondly, potable water is increasingly a problem in the US, particularly with respect to parasites. Since water is used for washing in many uncooked foods, and salads and fruit are an expanding part of the American diet, we need to make sure this problem is contained in the future.

Thirdly, *Campylobacter* and *Salmonella* are enteric pathogens which are killed by proper cooking. Their presence on the 'bad bug' most-unwanted list indicates 1) undercooking (e.g., of poultry on barbecues); 2) cross-contamination by food handlers; or 3) increasing consumption of uncooked foods.

Fourth, *Listeria monocytogenes* although low in reported case rate is high in mortality. Since this pathogen is ubiquitous in the environment and immunity post-infection is lifelong, this is an ideal situation for a vaccine for the elderly. How to protect fetuses is more quizzical, but since the

disease passes to the fetus, so should a vaccine. In the meantime, at-risk populations should avoid uncooked foods and reheat thoroughly cooked foods.

What is the effect of HACCP in all of this?

HACCP as it is mandated by USDA and FDA currently requires seven decade kills of *Salmonella* in cooking and pathogen-free packaged products. For this reason, it is unlikely that processed meats are a significant source of the *Salmonella* and *Campylobacter* caseloads. The rate of illness passing HACCP would be about 1:10,000,000 meals, compared to the 1:20,000 meals currently estimated by CDC.

How should we reallocate our regulatory and public health dollars?

Interestingly, USDA devotes considerable attention to *Trichina spiralis* in pork in its regulations and in its inspector workload. This particular pathogen is the very bottom of the ‘bad bug’ list, with an annual cost of only 2,500 days/yr. It seems apparent that more days/yr of inspector time are wasted on this pathogen than it costs in disease. The efforts of USDA should be refocused to more general risks and verification of HACCP plans.

Much more needs to be done to isolate the vehicles and mechanisms underlying foodborne disease. Where are the cases coming from? What food preparation activities exacerbate the risks? How can these risks be controlled? How many food handlers are virus carriers? What fraction of fresh fruit and vegetables are positive? We need a widespread study of our water and produce supplies and a health survey of our workforce.

The increasing consumption of uncooked produce is a large component of future risk. Efforts should be taken now by public health agencies to educate the populace concerning proper handling and preparation of these foods, and the hazards they contain.

A large part of the public health cost of *Salmonella* comes from *typhimurium* Enteritidis. This virulent serovar attacks even healthy individuals and has high morbidity. All laying flocks should be monitored for this pathogen, and all pooled sources should be tested and screened.

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