Hi Jennifer,
Nice report. The indicators are well described. I expect that these comments deal with issues that the HPAB have thrashed around already, but here they are.

p. 21. Measuring atrazine seems like a weak assay of the chemical contamination of source water, because it is a single chemical. Its increase or decline may not indicate the change in risk from chemical contamination. In contrast, estrogenicity is excellent because it quantifies a major kind of impact regardless of the specific contaminant or contaminants. Ideally, atrazine should be replaced by an assay or assays, such as immunosuppression or EROD induction, that quantify other kinds of impacts. If they are not adequately developed, then their development could be recommended.

p. 33. I was unaware that the 95th percentile was widely used to look at trends in *E. coli*, although it's not my area and I do not dispute that they are. The argument for looking at the tail of the distribution provided here is clear and reasonable, but my reservations about doing are that tails of distributions are relatively unstable (e.g., compared to medians) and also poorly quantified as MPN methods poorly quantify high or low concentrations.

p. 42. Delete the sentence "Alternate foods may have health promoting nutritional value, but may contain harmful contaminants along with saturated fats or sugars." It does not really add to the previous sentence, and gets onto soft nutritional ground.

p. 42. An additional recommendation could be to establish calibrations between whole fish and edible portion contaminants.

Thanks for the opportunity to comment.
Regards, Bill

On 14-04-01 3:01 PM, Boehme, Jennifer wrote:
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Dear Colleagues,

The International Joint Commission's Health Professionals Advisory Board (HPAB) is seeking public comment on an interim report on Recommended Human Health Indicators for Assessing Progress on the Great Lakes Water Quality Agreement until April 30. This interim report is a key product resulting from this community's participation in last year's Workshop on Human Health Indicators at EPA Region V Headquarters in Chicago, IL.

The interim report describes the identification and definition of recommended indicators that could be used by the governments and the IJC to assess and report on progress toward achieving the human health objectives of the Agreement.

The report recommended five indicators: 1) the Chemical Integrity of Source Water; 2) the Biological Hazards of Source Water; 3) the Illness Risk at Great Lakes Beaches; 4) the Identified Risks at Great Lakes Beaches; and 5) the Contaminant Levels in Great Lakes Edible Fish Species. These indicators relate to the Agreement objectives that the waters of the Great Lakes should be a source of safe, high quality drinking water, allow for swimming and other recreational uses and allow for the human consumption of fish.

The HPAB thanks you for your interest and previous participation in these human health indicator activities, and invites you to download a copy of the interim report from the public comment site. Any input on the interim report would be welcome, and can be submitted via the online form.

- See more at:

http://www.ijc.org/en_/hpab/Recent_Reports

Sincerely,

Dr. Jennifer Boehme

Secretary, Health Professionals Advisory Board

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Recommended Human Health Indicators for Assessment of Progress on the Great Lakes Water Quality Agreement, 2012-2015 Priority Series

Comments by Michael Murray, May 7, 2014

General Comments

I believe the report provides a good overview of the approach taken to develop human health indicators relevant to the Great Lakes Water Quality Agreement. One general point I believe could still be addressed is providing a little more context/review of other work on human health indicators. For example, between other recent IJC efforts (e.g., on risks and benefits of fish consumption - http://www.ijc.org/files/publications/C222.pdf) and other work of ATSDR (e.g. Great Lakes Human Health Effects Research Program), Environment Canada, or others, this work would have relevance to the current project, even if these other projects may not explicitly address indicators.

Specific Comments

P. ¶

4 For the List of Acronyms, the authors may consider an alternative format - i.e., listing the acronym, and then defining/expanding it, which in my experience is the more common convention.

5 (Executive Summary, initial paragraph). It would probably be worth mentioning briefly the origins of the effort – i.e., I believe it was in response to a charge from the Commissioners, correct? (e.g., drawing on info at start of Chapter 1). In that regard, should mention the IJC early on to set the context (even if it may be obvious to many readers). Also, HPAB should be written out on first use in ES.

6 (Executive Summary, 3rd paragraph). Concerning microcystin drinking water criteria in the U.S., even if not in regulation, it might be worth mentioning that Minnesota has developed guidance on Microcystin-LR (e.g. http://www2.epa.gov/sites/production/files/documents/microcystin.pdf)

6 Last sentence: “Turbidity is a useful measure that is associated with risk of human gastrointestinal illness.” I would think this could be qualified, by adding something like “can be” in place of “is”, given that in many cases, turbidity may reflect suspension of predominantly silt or other inorganic or organic matter, rather than largely microbes (as is discussed in more detail on p. 26).

11 Note that the drinking water indicators were cut off – i.e., the Drinking Water heading, and the first indicator (Chemical Integrity of Source Water).

12 Fish consumption, Purpose: The statement references "bioavailable contaminants of chemicals of concern", which is confusing/redundant; should decide on a more standard description (e.g. bioavailable chemicals of concern, etc.)

13 Table 3. Concerning alignment with GLWQA, for AOCs and LaMPs, the table indicates "Beyond Scope", even though at least two BUIs pertaining to AOCs are relevant to human health indicators (restrictions on fish and consumption, and restrictions on drinking water consumption - http://www.ijc.org/rel/boards/annex2/buis.htm#table1). Furthermore, later in the report, two indicators are noted as being relevant to both AOCs and LaMPs (Risk of Illness from Great Lakes Beaches, and Sources of Risk at Great Lakes Beaches, p. 32, 35, respectively).

14 The discussion is informative, and I think it was appropriate for the group to focus on hazard indicators, given challenges in getting at indicators of effect, cause-effect challenges, etc.

18 2nd paragraph. Note that the most recent SOGL report (2011) has come out, including a section on drinking water. Note also they reference other potential chemicals of concern in drinking water (e.g. arsenic, lead) – were any of those chemicals considered by the HPAB?

18 Concern Chemical Integrity of Source Water, an important issue is recognizing the potential for contamination of both surface and ground water – the latter is also important in the region, either as a direct drinking water source, or in connection with the Great Lakes (e.g. http://water.usgs.gov/ogw/pubs/WRI004008/WRIR_00-4008.pdf). As an indicator, it might be good to separate out measures involving sampling surface water vs. ground water, given that in many cases, we might expect significant differences (e.g. between concentrations of nitrate or pesticides in some ground waters underlying agricultural areas vs. open waters of Great Lakes).

20 1st partial paragraph. Sentence states: "The presence and variability of EDCs in drinking water sources can be assessed by monitoring the estrogenicity of these waters (Falconer et. al., 2006; Hecker and Hollert, 2009)." But presumably some chemicals may modulate endocrine activity but not display estrogenicity?

28 Last sentence. Concerning indicators, this sentence states: "Trend analysis should focus on extremes or exceedences of measurement rather than averages." It is not clear what "exceedence of measurement" references – presumably this is meant to say exceedence of a criterion or standard. In any case, averages can also be meaningful in a trend context, depending on the parameter, so this may warrant a little more explanation.

33 3rd paragraph has a sentence: "The high values of *E. coli* at the top end of the statistical distribution are of greatest public health concern…" While high values in general are more likely to be of concern, it is obviously important to consider additional issues. For example, in a different context of blood lead levels, the top 5% of exposures in U.S. children would have been at higher levels in the 1970s than currently, and more children would have had exposures above levels of concern in the 1970s as compared to currently (i.e., > top 5%). So I'm assuming we could imagine a hypothetical situation with a lot of overflows (or some other source water problem), with quite a few *E. coli* exposures above a level of concern.

35 Concerning Sources of Risk at Great Lakes Beaches, there has been a lot of work over the 10+ years on monitoring, microbial source tracking, etc., and it would be good to cite some of that work, including co-authored by former SAB member Richard Whitman and his colleagues at USGS, as it would surely have relevance to indicator development.

39 Last paragraph, 2nd sentence: "For instance, while the number and location of sampling sites are appropriate for assessment of ecological health, the number and location of sites are not appropriate for determining human health because they are not representative of the populations consuming fish or the fact that the majority of non-commercial anglers are catching nearshore, not offshore fish, and concentrations may vary widely between the two." I would challenge that the idea that existing sampling is not at all relevant to human exposures, which is what the above sentences imply. Many consumers would eat commercial fish (in restaurants, stores). In addition, in many cases, offshore fish may have lower concentrations of contaminants (than nearshore fish), so exposure estimates based on those offshore data would be more conservative.

40 First partial paragraph. For the sentence: "Lastly, the relationship between contaminant concentrations in whole body fish and the edible portion of fish are not well established or supported by scientific literature." This sentence needs a citation, including examples of cases where there is no relationship at all of whole body and edible portions (including for highly hydrophobic contaminants). For mercury, there is often a pretty good relationship (given that methylmercury mostly occurs in muscle tissue), and even for contaminants such as PCBs, I would think there would often be at least a weak relationship, in particular if you had data spanning a couple orders of magnitude in concentrations.

p. 25 Primary Author: Takara. I really don't like the logic behind this section. I find it a bit disorganized. In no particular order, here are some items:

- There are several Cryptosporidium species of concern besides parvum, and at least hominis should be acknowledged.
- In the U.S we don't examine source waters as much as drinking water, for obvious and completely understandable reasons.
- Monitoring source to tap would be enormously expensive and probably unwarranted. Concerns about fluctuations in source water turbidity are probably pointless.
- They mention measures for turbidity, nitrates, coliforms and crypto. There are a lot of other methods, and the "Standard Methods for the Examination of Water and Wastewater" has all this and much more. They are standard methods. Of these, measuring turbidity is the easiest. Nitrate and coliforms are uncomplicated. Crypto is complex.
- Turbidity can be as high as 5 in slow sand filtration systems, but should be a whole lot less in most purification systems. For instance, the Crypto outbreak in Milwaukee came about with a turbidity of 1.7.
- Turbidity is associated with parasitic infections, but has no correlation with bacterial pathogens. Here we depend on the coliform test, which is given a skimpy treatment here. For example, the report conflates E. coli with the much larger coliform group. We've got a hundred years of coliform experience; it is not difficult to access it.

p.32 Primary Author: Shapiro

Good as far as it goes. Nice and short. The report's comments about 95th percentile calculations are correct. It should be mentioned that the use of fecal streptococci is replacing E. coli for monitoring (a European idea). Here the percentile calculations are also relevant.

p. 35 Primary Author: Shapiro

Oddly, Sandra McLellan's name never comes up in this part.

This section is short on specifics.

As we discussed Dorevitch's comments are right on. Mussels do, to a large extent, control turbidity along many coastlines and so improving turbidity might be a misleading indicator of human interventions and are actually a positive result of having a new benthic filtering species in the great lakes. However more generally I would consider turbidity a poor predictor of human pathogens in the Great Lakes. Fecal coliform is a much more direct metric of bacterial contamination and so if that is being suggested as a metric (as it is) then go with that one as being much more specific to the question of bacterial contact. As I also mentioned the increasing water transparency which has resulted from the mussel invasion has also had the undesirable effect of increasing habitat (more illuminated bottom area) for the benthic nuisance alga Cladophora. The highly branched filamentous Cladophora is a great filter for bacteria from the water column so it harbors elevated bacterial concentrations even in waters which may have acceptable coliform counts. With the onset of DNA analysis our capacity to monitor actual human pathogens will be greatly expanded and provide the most relevant data but standard approaches across jurisdiction is a ways off yet.

I would also offer the further comment that I do not understand using nitrate as a metric for human health. It is true that there are drinking water standards for nitrate (as there are for other elements such as Cu, Cr etc but the exposure concentrations that pose a health hazard for drinking water are well above (essentially ten fold) the highest concentrations we see in the great lakes so the risk is non existent for using Great Lakes water as a drinking water source. Also nitrates are produced in the lake as well as being atmospherically deposited so they are a weak indicator on a lake wide basis of runoff pollution. Locally they have some investigative benefit as a tracer of urban runoff (as does chloride) but nitrate per se will never be a health risk in the Great Lakes. So if you want to reduce the number of measures I would suggest dropping this one.

Bob

The Recommended Human Health Indicators for Assessment of Progress on the Great Lakes Water Quality Agreement 2012-2015 Priority Series ("Recommended Indicators") is a significant step towards improving the health of Great Lakes and populations who depend on them. Once indicator tracking is implemented and hazards are identified, the signatories to the Great Lakes Water Quality Agreement of 2012 can take actions to protect and restore the integrity of the Great Lakes. I strongly endorse the approach and applaud the hard work of the all involved. There may be some opportunity to enhance specific elements of the suite of proposed indicators.

First, the use of turbidity as a human health indicator is potentially problematic. It is true that outbreaks of waterborne disease have been linked to high turbidity in source water, often indicative of fecal contamination. It should be noted that zebra mussels, a threat to biological integrity of the Great Lakes, are known to reduce turbidity. Zebra mussels and quagga mussels are considered invasive species in the Great Lakes. As mussels consume phytoplankton, food webs are disrupted. However plankton consumption increases water clarity (and therefore, decreases turbidity). Hugh MacIsaac of the Great Lakes Institute for Environmental Research, University of Windsor, Windsor, Ontario provided an early review of this topic in American Zoologist, 1996. In that report and subsequent publications he describes drops in turbidity in relation to mussel invasion. Thus, as an environmental health indicator, turbidity is problematic in that apparent improvements in human health risk (decreased turbidity) might be due to worsening biological integrity of the Great Lakes, rather than due to decreased pollutant discharges.

A second potential modification to the document is the "Sources of Risk at Great Lakes Beaches." The identification of main pollution sources and the percentage of beaches that employ a Sanitary Survey or Environmental Health and Safety Survey are data elements worth tracking. However, information should be specifically sought and compiled about combined sewer overflows (CSOs) and agricultural runoff. The should be better indicators of human health risk. CSOs are a source of viruses, bacteria, and protozoa found in human fecal pollution. Surface runoff from agricultural areas contains nitrates, phosphates, bacteria and protozoa. In diverse settings heavy precipitation and subsequent contamination of drinking water sources have been identified as factors that led to waterborne disease outbreaks, either as a result of CSO or of agricultural runoff. In some jurisdictions, heavy precipitation and/or CSO events also trigger swim bans at Great Lakes beaches. The magnitude and/or duration of CSO events can be estimated and in some settings. An inventory of the locations and populations impacted by CSOs and agricultural runoff, as well as estimates of the frequency of such flows would be particularly useful as indicators. The Third National Climate Assessment (draft until May 6, 2014) calls for increased precipitation and more frequent heavy rain events in the Great Lakes states as the earth continues to warm. Thus, the hazards presented by CSOs and agricultural runoff are expected to become more pressing with time.