



## Navigating data quality

### Part 2: Seasonality and nutrition data

#### Intro

##### Slide 1

A warm welcome to you all for this short presentation on seasonality and nutrition data. It's great to have you join me online. My name is Phil James and I'm one of the Senior Technical Associates with the Emergency Nutrition Network. Over the next 20 minutes or so I'm going to take you through some considerations of the impact of seasonality on nutrition outcomes and why we need to bear this in mind when we're interpreting data.

This is the second in a series of three mini presentations on navigating data. My colleague Eilise addresses survey interpretation in the first presentation, and my colleague Stephanie goes onto consider global estimates of severe acute malnutrition treatment coverage in the third presentation.

#### Presentation Outline

##### Slide 2

In this presentation the overall objective is to consider why it is important to consider seasonality when interpreting nutrition data.

The focus here is mainly on survey data, and especially on estimates of wasting, although the concepts will be applicable to lots of different types of nutrition data. There is a wealth of literature regarding the impact of seasonality on other nutrition indicators and outcomes, which would take us much longer than 20 minutes to address, but I will point you to further reading at the end if you are interested to explore the topic further.

Today we will cover

- What we mean by seasonality, and examining the seasonality of nutrition and health outcomes
- A more specific look at the seasonality of wasting trends
- Associations between temperature and wasting
- We will then look at the timing of nutrition surveys, and how this affects wasting estimates
- A quick look at how we might improve how we measure and account for seasonality
- And finally, looking at the implications of all this for how we track progress on wasting against global targets

So, to start this presentation, let's look at a quick definition of seasonality.

## Seasonality of nutrition and health outcomes

### Slide 3

Seasonality is a term that captures regular fluctuations over time, and these fluctuations can be in a number of exposures: environmental exposures, food security related ones, nutrition related ones, access to healthcare. I've put some more examples on the screen here. Seasonal fluctuations in these variables might not happen at the same time, nor follow the exact same pattern over the year. Hence it can be quite challenging at times to disentangle what we mean by seasonality.

Because seasonality is a proxy marker for so many variations in important exposures, many studies do look at differences in nutritional status between seasons. So, you may have come across studies comparing rainy and dry seasons, for example, or maybe summer versus winter.

### Slide 4

There's a useful definition that gives us more detail on this from a recent paper written by a team at Tufts University. They quote *"seasonality in malnutrition refers to any pattern or variability in nutrition outcomes that are correlated with the seasons, specifically with changes in environmental conditions such as temperature, rainfall and vegetation"*.

The effect that seasonality has on health and nutrition is well-described for many outcomes, even if not all outcomes.

We can take, for example, observations written by Robert Chambers back in 1979. He was describing in his paper then that the majority of the rural poor do experience marked seasonality in nutrition/health outcomes between wet and dry seasons. Namely in the wet season there are peaks of illnesses, undernutrition and mortality.

There is also a peak of infections in the wet season including diarrheal diseases, malaria and dengue fever. Often, although not consistently, the wet season is the hungry season. This is a time when crops are growing, harvest stocks are depleting, and there's often increased energy expenditure for those engaged in agricultural manual labour.

So, the role of seasonality on nutrition outcomes is well known, and indeed it is one of the important factors that, for example, food security predictions in Kenya and Somalia take into account. So, in those early warning systems, agencies will look at rainfall assessments, as they know that seasonality has such an important role in food security.

### Slide 5

Another helpful quote here is taken from a paper written back in 2009 on seasonal hunger:

*"Most of the world's acute hunger and undernutrition occurs not in conflicts and natural disasters, but in the annual hunger season. So, the time of year when the previous year's harvest stocks have dwindled, food prices are high and jobs are scarce"*.

And I thought this figure was a nice example of the seasonal influence on some of these factors I've mentioned. This is data from Niger in 2007. It shows us the number of cases of severe acute malnutrition and malaria over the year; that's the left-hand axis. The right-hand axis shows us the amount of rainfall over the year. So, the wet season, which we can see with the peak of the blue dotted line showing rainfall, corresponds to the hunger period. Also corresponding with the hunger period, we have an increase in the number of cases of severe acute malnutrition, shown by the light blue line, where we see cases peaking just slightly after the height of the rainy season.

We also see that we have an increased number of cases of malaria in the hunger period, shown by the red line, which again closely follows the rainfall pattern with a slight lag.

So, in summary, we have an overlapping hungry period, rainy season, peaks in malaria, and peaks in severe acute malnutrition; all aligning together.

## Seasonality of wasting

### Slide 6

Let's look at some further examples from the literature. There's a nice study by Sophie Chotard and her team that collated almost 900 surveys from the Greater Horn of Africa, which the UNICEF Regional Office had compiled. These were mostly SMART surveys or at least 2-stage cluster surveys and they were looking at wasting measured by weight-for-height z-score (WHZ) among children aged six to 60 months.

### Slide 7

So, looking at all the data, they found that seasonal fluctuations within a given year demonstrated roughly a 5-percentage point difference in the prevalence of wasting. Although in some years this was as high as a difference of 10-percentage points between the seasons. These seasonal fluctuations were greater in years that had an overall higher prevalence of acute malnutrition.

The impact that seasonality had on acute malnutrition depended on the livelihood strategy. So, for example, here on the left we have data that comes from pastoral areas of Somali region of Ethiopia. Pastoralism describes a livelihood strategy where income is largely derived from domestic livestock, where most of the feed / pasture is natural rather than cultivated. And then on the right we have data from Oromia Region where people rely on agriculture primarily. And so very generally speaking, we can see a higher seasonal fluctuation in pastoral areas compared to those in agricultural areas. Pastoral areas are very susceptible to drought in Ethiopia, which may explain some of the variability in acute malnutrition, however, note that even in agricultural areas we can see there is still marked seasonal fluctuation.

## Temperature and wasting

### Slide 8

The two previous studies have looked at seasonality defined by rainfall and month of the year, respectively. We can also look at temperature records. On this slide we have an example from a very recent paper. Rachel Baker and her team took data from almost 200,000 children from 30 countries across Sub-Saharan Africa. They took anthropometric data from Demographic and Health surveys, and

they paired that with climate data from the University of Delaware. Each child's anthropometric data was matched with the historical temperature data using the child's location and the date of the survey. The children in this analysis were aged one to five years.

I thought it was interesting to look at this paper, not only because it looks at temperature records but also because it looks at weight-for-height z-scores (WHZ) on a continuous scale, rather than just looking at cut-offs of wasted children.

The authors give a nice reminder of the rationale for looking at seasonality, and this quote reinforces some of what we talked about earlier.

*"High temperatures reduce food security by lowering agricultural productivity, alter transmission dynamics for a range of diseases, increase water scarcity and worsen sanitation outcomes, increase the risk of violent conflict and reduce labor productivity, incomes and economic growth".* So, there is huge potential impact of seasonality on a number of factors that can influence nutrition outcomes.

### **Slide 9**

So first they took a very broad look at a wide regional level, of patterns of average temperature and child weight for height z- score. Here on the slide is the 50-year average temperature on the left, and then the average child weight for height z- score on the right. Very broadly speaking, you can see that the higher the temperature, the worse (i.e., lower) the weight for height z- score. You can see this is particularly the case in the Sahel region, for example. This is simply an overview, and says nothing about causality, but still very interesting overall observations.

### **Slide 10**

Then what they did was to look at the effects of a change in average annual temperature compared to the previous year. They are using 25 degrees Celsius as their comparison point. So, for example, if in a given year the average temperature was 26 degrees instead of 25 degrees, they plotted the change in weight for height z- score on the figure. Overall, this figure shows us that if we have a 1 degree increase in annual temperature, it is associated with a decline (i.e., worsening) of approximately 0.08 weight for height z-scores. This is particularly apparent when temperatures increase beyond 25 degrees.

You can see this pattern of worsening weight-for-height z-scores with higher temperatures occurs both in rural and urban areas, although the association seems to be stronger in rural areas.

So that was the effect of changing average annual temperature.

### **Slide 11**

They also looked at the change in average temperature in a given month compared to the previous month, which is very relevant for us when we consider seasonality of nutrition surveys. So here again, we have very general trends demonstrating that if a month is hotter than 25 degrees compared to the previous month, we see deteriorating weight for height z score. Again, this occurs both in rural and urban areas.

Overall, an increase in the average monthly temperature from 25 to 35 degrees was associated with a worsening in weight for-height of 0.2 z-scores.

I'm sure that you are starting to see why these associations between child nutrition status and indicators of seasonality (i.e., temperature, rainfall, month of the year) are critical to consider when we interpret nutrition survey data.

So, let's look at this aspect a little more closely now.

## Timing of nutrition surveys

### Slide 12

The timing of nutrition surveys matters. This applies even when we're looking at nationally-representative surveys that have used standardized methodology. We might think because the methodology is standardized for surveys such as Demographic and Health Surveys (DHS) that the timing of the surveys is standardized as well. However, that is not necessarily the case. I briefly looked at the database of DHS surveys available online and picked two countries just to have a look at the timing of the most recent nationally representative surveys.

In Indonesia the 2017 DHS started data collection in July, whereas in 2012 this was the month the data collection finished. Then in Liberia, the most recent DHS survey took place from October through to February. However, back in 2013, data collection took place in a completely different time of year from March through to July. So, we need to bear in mind that even for these standardized, nationally-representative surveys, we still need to take seasonality into account. If we compare survey results from different times of the year we may be getting a false sense of the progress or deterioration in a country.

### Slide 13

So, what really are the implications of comparing surveys in different seasons? What difference would just three months make, for example? Well, it potentially makes a big difference in the estimates of undernutrition, particularly prevalence of wasted children. Here we have a paper that looks at the prevalence of wasted children in Somalia in four different seasons, and these are very roughly three months apart.

So, if we just look at region A in South/Central Somalia, for example, just we can see that three months apart the prevalence of wasted children is increasing dramatically in pockets of region A over three-monthly intervals. So, even a three-month difference in the timing of a nutrition survey could make a big difference to the estimated nutrition outcomes.

### Slide 14

We can see this displayed more clearly here, in a figure from the same paper. This is the same data, looking at the odds of wasting, so the likelihood of a child being wasted, across the four different seasons. We can see that the highest odds of a child being wasted was found in the main dry season and the lowest odds of a child being wasted was in the main rainy season, just three months difference. So, we have dramatically different odds of being wasted according to when nutrition data is collected.

## Improving measurement of seasonality

### Slide 15

So, if seasonality is so important to capture to help us interpret our data, how do we improve the ways we measure and account for it?

There's a really nice paper by a team from Tufts University who have written a primer on how seasonality of malnutrition is measured and analyzed, and I just wanted to flag this paper as a nice place to go to if you want more information on the topic I've talked about today.

They give some pointers for how we might need to improve our estimates of malnutrition, taking seasonality into account, they give an example from Chad.

In Chad, data collection in June, for example, might capture the dry season, or it might capture the initial intermittent rains. Or it might capture the main rainy season, it all depends on the year of data collection.

So, to get better estimates of when to capture the main seasons year by year, they say that we should place greater value on local knowledge, and local perspectives on seasonality. We should be collecting higher frequency longitudinal data and make use of remote sensing data where we can. We need to try and model multiple peaks in nutrition outcomes over the year, and the authors go on to explain some of the ways this can be done. They suggest that we should try where possible to learn from infectious disease epidemiology that has a long experience of modeling seasonality.

### Slide 16

I won't go into this now, but just to say that the authors also go through the different ways in which seasonality has been taken into account in various studies looking at seasonality and nutrition outcomes. They take us through some of the statistical techniques and some of the advantages and disadvantages of the different approaches.

So, it's a very useful primer to bring together some of the topics that we've been talking about today, and I'll add the reference on a slide at the end.

## Implications for tracking progress against global targets

### Slide 17

Why does all this matter? One of the reasons it matters is because we're working towards global targets, and whilst we have trends in the latest joint child malnutrition estimates in decreasing stunting prevalence, and we have trends in overweight as well, we don't have trends portrayed for wasting. The Joint Child Malnutrition estimates goes into some of the reasons behind that in their methodology. In summary, it is difficult to get trends on wasting, and seasonality of wasting, indeed, is one aspect that makes it difficult to compare data over time.

### Slide 18

Some authors have really articulated this key point nicely. There was a commentary in the *Lancet Child and Adolescent Health* journal recently, with the authors presenting some data from nutrition surveys in Ethiopia. One survey round was from March 2017 and one was a few months later, in August.

I quote from them; they say: *“our data collected in 2017 from chronically food insecure areas in four regions of Ethiopia show an almost halved prevalence of wasting between March and August. Does this finding mean that Ethiopia is on course to meet the World Health Assembly target of reducing and maintaining childhood wasting to less than 5% if the data were collected in August, and off course if the survey took place in March of the same year?”*

So according to which season the data is coming from, we have very different estimates of whether we're on track or off track for meeting these global targets.

## Conclusion

### Slide 19

In summary, when interpreting nutrition data it is critically important to consider the season the data were collected in. Looking at seasonal trends will then provide the context to aid interpretation of the data. This is applicable when interpreting many types of nutrition data, but especially data on wasting. Remember that comparing nutrition data from different seasons may give us a false sense of the progress / deterioration. Where possible we need to compare data taken in the same season, or if that is not possible, at least account for the role seasonality may have had in our data. This is critical to consider when we are quantifying progress against e.g., the WHA target of reducing wasting prevalence to <5%.

Finally – a challenge to us all in light of this. Are the types of surveys we do, or the way we portray the results, actually fit for purpose for tracking progress? Maybe we don't have the answer right now, but I hope that you found this useful just as a way of thinking about where does the nutrition data that we're looking at come from, what time of year, and what might the impact be on some of these estimates of nutrition outcomes, particularly for wasting prevalence.

### Slide 20

For your future reference, here are just a few examples of papers you can read to find out more about the role of seasonality on various nutrition outcomes.

## Close

### Slide 21

I'd like to thank our donors who generously supported us to make this presentation: Irish Aid and the Eleanor Crook Foundation.

I hope you'll continue to watch our third presentation in this series, which is looking at coverage data.

Finally, we would really appreciate feedback on this presentation and any others you have watched in this series. On the MediaHub page where you found this video there is a link to a very short survey that will only take a couple of minutes to fill in. We would love to know how useful you have found these short presentations, what we could improve on, and your thoughts on future topics. We would be very grateful if you could make time to help us improve similar work going forwards. Thank you for your time.