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# R code for working with LMS files, from Urlacher et al., "Physical Growth of the Shuar: Height, Weight, and BMI References for an Indigenous Amazonian Population"
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```
#This function produces centile values for given ages and LMS values.  
centilesLMS<-
```

```
function(Age,Sex,LMSlookuptable,cent=c(0.02,0.05,0.25,0.50,0.75,0.95,0.98)){  
  useLMS<-apply(data.frame(Age,Sex), 1, function(x)  
  which.min(abs(LMSlookuptable$Age-  
  as.numeric(x[1]))+(x[2]!=LMSlookuptable$Sex)*999))  
  LMS<-LMSlookuptable[useLMS,c("Lambda","Mu","Sigma")]  
  getcent<-function(la,mu,si){  
    sapply(cent,function(x)  
    exp(log(qnorm(x)*la*si+1)/la+log(mu)),simplify=TRUE)  
  }  
  if(length(cent)==1) o<-cbind(Age,apply(LMS,1,function(x)  
  getcent(x[1],x[2],x[3])))  
  else o<-cbind(Age,t(apply(LMS,1,function(x) getcent(x[1],x[2],x[3]))))  
  o<-data.frame(o)  
  names(o)<-c("Age",cent)  
  o  
}
```

```
#This function calculates a z-score from a measure and the appropriate LMS values.
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```
ZfromLMS<-function(measure,la,mu,si){  
  zs <- ((measure / mu)^la - 1)/(la * si)  
  zs  
}
```

```
#function to get z-scores for a given age and value. Sex, age, and value need to be in the same units or with the same coding scheme as is used in the LMS table.
```

```
getZ<-function(Age, Sex, Value, LMSlookuptable){  
  useLMS<-apply(data.frame(Age,Sex), 1, function(x)  
  which.min(abs(LMSlookuptable$Age-  
  as.numeric(x[1]))+(x[2]!=LMSlookuptable$Sex)*999))  
  LMSmatches<-LMSlookuptable[useLMS,]  
  ZfromLMS(Value,LMSmatches$Lambda,LMSmatches$Mu,LMSmatches$Sigma)  
}
```

```
#just a wrapper. Uses pnorm to get centiles from the Z-scores in getZ
getCentile<-function(Age, Sex, Value, LMSlookuptable){
  zs<-getZ(Age, Sex, Value, LMSlookuptable)
  cent<-pnorm(zs)
  cent
}
```

```
#example usage
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```
#read in LMS files
HT.LMS<-read.csv("ShuarHeightByAgeLMS.csv")
WT.LMS<-read.csv("ShuarWeightByAgeLMS.csv")
BMI.LMS<-read.csv("ShuarBMIByAgeLMS.csv")
```

```
#get a z-score for an 5 year-old male, 97cm tall
getZ(5,"Male",97,HT.LMS)
```

```
#get a Centile value
getCentile(5,"Male",97,HT.LMS)
```

```
#get z-scores for three individuals
growthdat<-
  data.frame(Age=c(5,5,15),Sex=c("Male","Female","Male"),Weights<-
  c(15,15,40))
getZ(growthdat$Age,growthdat$Sex,growthdat$Weights,WT.LMS)
```

```
#what are the 5th, 50th, and 95th centiles for males at age 5 and age
10?
centilesLMS(c(5,10),"Male",HT.LMS,cent=c(0.05,0.50,0.95))
```