

Timezone Correction of Dates

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ABSTRACT

Within a trial the dates typically refer to the timezone in which the treatment center is located. However, if randomization is done centrally, then this point in time may be expressed in a different timezone. For consistency between dates it is essential that also the randomization date is then expressed in the local timezone of the treatment center.

This paper provides a structured method to enable this conversion.

INTRODUCTION

A single trial can have treatment centers around the world. Certain activities, most often randomization, may be performed centrally, with timestamps also captured by the system. For the analysis of the clinical data it is then essential that the timestamp of the central activity is made comparable to that of the locally CRF collected timestamps.

At least the standard timezone of each center and of the central system need to be looked up. These are standards, not dependent on the clinical data themselves. Therefore they can be maintained at a central location, apart from the other clinical data.

The use of Daylight Saving Time also affects the timezone. Unfortunately, Daylight Saving Time varies greatly between locations and in time, so that it is difficult to take this into account. A more simple approach will be used instead.

TIMEZONES

In our example trial we have treatment centers in Seattle, Los Angeles, New York, London and Sydney. The randomization is done over the phone, with investigators calling a voice operated system based in Amsterdam. In this trial we have data being collected in five different timezones:

Standard Timezone, relative to Universal Coordinated Time (UTC)	Treatment center code (City)
UTC - 8	US217 (Seattle), US393 (Los Angeles)
UTC - 5	US206 (New York)
UTC	GB008 (London)
UTC + 10	AU404 (Sydney)

plus the timezone of the randomization system:

UTC + 1	NL000 (Amsterdam)
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The timezone difference against UTC can be captured in an informat:

```

invalue utcdiff 'US217', 'US393' = - 8
                'US206'         = - 5
                'GB001' - 'GB999' = 0    /* all GB centers in same timezone */
                'NL000'         = + 1
                'AU404'         = +10 ;

```

By using this informat the timezone details can be documented more clearly within your trial programs: they typically originate from an external, non-clinical data source. Moreover, if center codes follow a company standard, i.e. in all trials a center code always indicates the same treatment center, then such an informat can also be maintained as a company standard.

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The timezone difference between the local treatment center and the randomization system now follows from:

```
zonediff = input(centercd, ?? utcdiff.) - ( +1 ); /* +1 for timezone Amsterdam */
```

The double question mark ?? in above input statement suppresses SAS messages on invalid center codes, including those center codes that could not be found in the informat. The following will check the completeness of the informat:

```
if zonediff=. then
  put "WAR" "NING: add timezone details in informat UTCDIFF for " centercd;
```

In an automated system the timestamp typically is a date/time, as opposed to date only. Therefore the randomization date/time (randcdat/randctim) of the system can be converted to date/time (randomdt) in the timezone of the treatment center:

```
randomdt = randcdat*'24:00't + randctim + zonediff*'01:00't;
```

DAYLIGHT SAVING TIME

So far the effect of Daylight Saving Time (DST) was not accounted for. DST can affect both the timezone of the treatment center and that of the central system. DST typically means that the clock is moved forward one hour as opposed to Standard Time.

The problem with DST is that its start and end date vary between geographical regions, and may change significantly from year to year. For example, in 2007 the DST start date in the USA changed from the last to the second Sunday in March.

Not all regions use DST, specially not those close to the equator. If applied, DST in the Northern hemisphere often is effective from April to September, and from October to March in the Southern hemisphere.

Some examples of the uncertainty in timezone difference due to DST:

City	DST in 2009	Time difference with Amsterdam			
		DST 2009: 29 Mar – 25 Oct			
		Standard Time	DST corrected		
			20 Mar	3 Apr	10 Apr
Honolulu	No DST	- 11	- 11	-12	-12
Seattle	8 Mar – 1 Nov	- 9	- 8	- 9	- 9
Sydney	2008 – 5 Apr ; 4 Oct – 2010	+ 9	+10	+ 9	+ 8

In most trials the CRFs only use dates not times, so that the date alone will be sufficient detail for the analyses:

```
randomd = datepart(randomdt);
```

Only when the timepart (in local timezone) is close to midnight could the date be uncertain due to DST. Fortunately, trial activities like randomization do not normally occur close to midnight. Therefore we can verify the correctness of the date as follows:

```
if not( '02:00't <= timepart(randomdt) <= '22:00't ) then
  put "WAR" "NING: verify correctness of derived local date/time " RANDOMDT;
```

Some examples of actual timezone conversion (all in the year 2009):

City	Timepoint of randomization			Remark on uncertainty of timezone correction due to possible DST
	Amsterdam time	Timezone corrected*		
		Date	Time	
Honolulu	20Mar 23:55	20Mar	12:55	Local time close to midnight, date uncertain
	21Mar 10:44	20Mar	23:44	
Seattle	20Mar 17:01	20Mar	08:01	Local time close to midnight, date uncertain
	21Mar 09:32	21Mar	00:32	
Sydney	20Mar 05:12	20Mar	14:12	Local time close to midnight, date uncertain
	20Mar 15:08	21Mar	00:08	

* date/time at the local city, assuming Standard Time both in Amsterdam and the local city

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CONCLUSION

If a timepoint needs to be corrected into the time of another timezone then it simplifies the documentation if you store the timezone details more or less separate from the true clinical data. One possibility is to specify the timezone details in an informat.

Keeping the accurate clocktime-precision in the timezone corrected timepoint is not easily possible, due to the uncertainty caused by Daylight Saving Time. However, because activities at a treatment center typically do not occur around midnight, we can with great certainty derive the correct date in the timezone of the treatment center.

RECOMMENDED READING

The website www.timeanddate.com contains a wealth of information on timezones and Daylight Saving Time.

CONTACT INFORMATION

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