An Alternate Way to Create the Standard SDTM Domains
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ABSTRACT
Sponsors who initiate clinical trials after 2016-12-17 are required to submit data from the studies in CDISC Study Data Tabulation Model (SDTM) format in their FDA submission. SDTM Implementation Guides provide the rules, assumptions, and examples necessary to create the standard domains. It is common practice to use software tools to assess compliance with CDISC standards before transmitting the domains to a regulatory agency. By pre-building the standard domain templates directly from the CDISC Share data stores, compliance with metadata (type, storage, and internal documentation) is guaranteed. These version-specific templates are then used as the scaffolding to which study-specific data are added. This paper outlines how this top-down approach minimizes coding issues as well as errors/warnings raised by metadata checking tools. A macro with dual functionality will be presented. One function utilizes the metadata library to produce specific standard domains variables, labels and their canonical order in that domain. The second function derives the maximum length of each individual character variable and assigns that length to that variable. This paper is intended for people new to CDISC requirements and operating with limited corporate resources.

INTRODUCTION
FDA has mandated that, for NDAs, BLAs, ANDAs and their subsequent submissions, the clinical data must be submitted in CDISC formats for studies that start after 2016-12-17. This paper is intended for an audience with limited corporate resources, and provides insight into building a metadata (provided by CDISC share) driven solution to implement the SDTM standards. Sponsors with abundant resources, can afford to develop their own or purchase third party MDRs (Metadata Directory Repository) to maintain the SDTM IG standards; hence it is easy for them to implement the regulatory standards. For sponsors with limited resources, it is difficult to develop or obtain third-party MDRs.

It is common practice to verify the SDTM domains using tools such as Pinnacle 21. Based on generated warnings/errors, one makes the necessary changes to SAS code to address them wherever applicable, and if not, explain them in a Reviewer’s Guide. By relying on CDISC published data standards, and a single, streamlined macro, one avoids the aggravation of tracking down and adjusting myriad miniscule code details across multiple domains.

OVERVIEW
Rather than creating the SDTM domain, and then relying on Pinnacle 21 tool to verify compliance, one can use CDISC share provided SDTM metadata as a foundation, minimizing the problems created and subsequent code modifications.

We created a SAS library (Figure 1) from the CDISC share metadata. It has all the individual standard SDTM domains. Each domain (i.e. Figure 2) has its variables in the required order. The variables are associated with their respected labels. By using these templates, one reduces the use of many ATTRIB or LABEL statements to assign the labels to each variable (Figure 3) during their creation. This approach also avoids typing (spelling or casing) errors. One should use only LENGTH statement while creating the character standard variables. Because the order is provided in these templates, it assures the final dataset variables will be in the required order.

FDA requires the EPOCH variable in most of these domains, and each character variable must match the maximum length of its longest observed length. CDISC SDTM share metadata doesn’t provide EPOCH variable in all the domains. We included the EPOCH variable in each standard domain where required, and at the required position within the created SAS library (Figure 1). Our macro assigns the appropriate labels to the standard SDTM variables, calculates the maximum observed length of each variable, and then orders the variables to comply with the specifications.
Figure 1 – SDTM standard domains SAS library

Figure 2 – SDTM Demographics (DM) domain

<table>
<thead>
<tr>
<th>STUDYID</th>
<th>DOMAIN</th>
<th>USUBJID</th>
<th>SUBJID</th>
<th>RFSTDTC</th>
</tr>
</thead>
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<td></td>
<td></td>
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</tr>
<tr>
<td>RFENDTC</td>
<td>RFXSTDTC</td>
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<td>RFCDTC</td>
<td>RFPENDTC</td>
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</tr>
<tr>
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<td>DTHFL</td>
<td>SITEID</td>
<td>INVID</td>
<td>INVNAME</td>
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<td>AGEU</td>
<td>SEX</td>
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<td>ARMCD</td>
<td>ARM</td>
<td>ACTARMCD</td>
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<tr>
<td>COUNTRY</td>
<td>DMDTC</td>
<td>DMDY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>27</td>
<td>28</td>
<td></td>
<td></td>
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The end process consists of three steps: building the penultimate dataset; calling the macro, which generates two global macro variables, and then creating the desired SDTM domain in a regular Data step, which employs the above macro variables.

The penultimate dataset is created using a combination of CDISC guidelines (variable names) and local specifications (defining age, Study Day #).

Then, one calls the macro by supplying at least two keyword parameters. The first \( \text{ind} \) specifies your penultimate dataset name to modify (apply variable labels); the second \( \text{supply} \) specifies the template dataset name that supplies the CDISC share metadata labels and appropriate variable order. Two global macro variables are produced during macro execution.

These will be used in a very simple Data step to create the final domain. Macro variable \&varlist\_length contains the string of required variables with their derived lengths (delimited by a space) in the required order, to be used with length statement in the final Data step. Macro variable \&varlist\ is a list of the mandatory variables to keep in that standard domain.

**CONCLUSION**

While creating SDTM domains, developing a small set of macro tools enables one to achieve compliance with regulatory guidelines with minimal effort and minimizes the chance of error. It ensures adherence to the data standards and reduces the possibility of creating metadata errors and having to fix them in post processing.

The opinions expressed in this paper are the opinions of the author and should not be interpreted as the opinion or position of Omeros Corporation.
REFERENCES
https://www.cdisc.org/
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Macro and its usage are presented below:

```sas
%macro Lab1Len(ind = , supply =, dlib =);
  %local dat varnum sqvar vnum ;
  %global varlist_length varlist;
  %let dat = flengs1;
  /* Applying appropriate labels to your data variables ;
  %if %length(&ind) eq 0 %then %do;
  %let ind = &syslast;
  %end;
  %if %length(&dlib) eq 0 %then %do;
  %let dlib = cdisc;
  %end;
  proc contents data = &dlib..&supply
    out = cdisc..&supply. (keep = name label varnum)
    nodetails
    nprint;
  run;
  proc sort data = cdisc..&supply. ;
    by name ;
  run;
  proc contents data = &ind.
    out = yourdata (keep = name varnum type)
    nprint ;
  run;
  data yourdata;
    set yourdata;
    name = upcase(name);
  run;
%mend;
```
An Alternate way to Create the Standard SDTM Domains, continued

```plaintext
67 proc sort data = yourdata ;
68 by name;
69 run;
70
71 data ourdata;
72 merge yourdata (in = a rename = (varnum = vnum))
73   cdisc_supply. (in = b);
74 by name;
75 if a and b;
76 length varlab sqvar $200 ;
77 varlab = catx(' = ',name,quote(strip(label)));
78 if (type eq 2) then sqvar = catx('',
79 cats('max(length('name',')), ' as',
80 cats('len',varnum)
81 );
82 else if (type eq 1) then sqvar = cats('8 as len',
83 varnum);
84 run;
85
86 proc sql noprint;
87 select varlab, sqvar, varnum into :varlab separated by ' ',
88 :sqvar separated by ', ',
89 :varnum separated by '/'
90 from ourdata
91 order by varnum;
92 quit;
93
94 proc datasets library = work nolist;
95 modify &ind;
96 label &varlab ;
97 run;
98 quit;
99
100 quit;
101```
%* Get the max length of your data variables;
proc sql;
  create table lenas as
  select sqvar.
  from &ind;
quit;
proc transpose data = lenas
  out = tlenas;
  var len;
run;
proc sql;
  create table flenas as
  select a.*, b.coll as lengt
  from curdata a left join tlenas b
  on strip(scan(a.sqvar,-1,' ')) eq b._name_
quit;
data &dat;
  set flenas;
  length wanted $10;
  if (type eq 2) then wanted = cats('5',lengt);
  else wanted = strip(put(lengt,8.));
  if (substr(name,length(name) - 1) eq 'FL')
    then wanted = '51';
  if length(name) ge 6 then do;
  else if (substr(name,length(name) - 3) eq 'STAT') then wanted = ' staples';
  end;
runt;
proc sql noprnt;
  select cats(' ', upcase(name),wanted),
     name,
    varnum
  into: varlist_length separated by ' ',
  : varlist separated by ' ',
    : vnum separated by ' ' 
  from &dat
  order by varnum;
quithmend;
Example Demographics (DM) dataset creation:

```r
data dm0;
set rawdata.dm (rename = (race = racel) drop = studyid siteid);
length usubjid race raceoth1 raceoth2 $40;
studyid = project;
domain = 'DM';
subj = subject;
siteid = sitenumber;
usubjid = catx('/',
    studyid,
    subj);
rficdtc = put(input(compress(consdc_raw),date9.),ymymdd10.);
if index(brthdat_raw,'UN') and
    index(brthdat_raw,'JUN') lt 1 then put 'WAR' 'NING: Fix the below.';
brthdtn = put(input(compress(brthdat_raw),date9.),ymymdd10.);
ageu = 'YEARS';
ethnic = upcase(ethnic);
race = race realidad;
if (race eq 'OTHER') then do;
    put /racel;
    raceoth1 = scan(racel1,'/');
raceoth2 = scan(racel2,'/');
    if index('AGpath','prod') then put 'WAR' 'NING: Check the race other.';
end;
sex = first(sex);
visit = 'VISIT 1';
visitnum = 1;
run;
```

... (Continue to create the penultimate dataset and then use the macro.)