```
*****************************************************************************.
** Program Name   : adc19ef-ve-cov-7pd2-peds-eval.sas                    **;
** Date Created   : 22Mar2021                                       **;
** Programmer Name : (b) (4), (b)                                     **;
                     (6)
** Purpose        : Create adc19ef-ve-cov-7pd2-peds-eval              **;
** Input data     : adc19ef                                      **;
** Output data    : adc19ef-ve-cov-7pd2-peds-eval.html              **;
*****************************************************************************.
options mprint mlogic symbolgen mprint symbolgen mlogic nocenter missing=" ";
title;
footnote;

proc datasets library=WORK kill nolist nodetails;
quit;

%let prot=/Volumes/app/cdars/prod/sites/cdars4/prjC459/nda2_unblinded_esub/euaext_esub_adam/saseng/cdisc3_0;
libname datvprot "&prot./data_vai" access=readonly;

%let codename=adc19ef-ve-cov-7pd2-peds-eval;
%let outlog=&prot./analysis/esub/logs/&codename..log;
%let outtable=&prot./analysis/esub/output/&codename..html;

proc printto log="&outlog" new;
run;

/*** Population Flag **/

proc sql;
  create table popf as select distinct usubjid, evaleffl, trt01pn, trt01p, aai2effl
  from datvprot.adsl
  where EVALEFFL='Y' and MULENRFL ne "Y" and PHASEN ne 1 and HIVFL = 'N' and 12 <= agetr01 <= 15
  order by usubjid;
quit;

proc sql;
  create table adc19ef as select *
  from datvprot.adc19ef
  order by usubjid;
quit;

data tpop;
  merge adc19ef (in = a) popf (in = b);
  by usubjid;
  if a*b;
run;

/***** Total Population ****/

proc sql;
  create table dsin as select distinct subjid, trt01pn, trt01p, paramn, paramcd, param, CDCRMUFL, CDP27FL,
PDRMUPFL,
  aval, avalc, evaleffl, PDP27FL, pdrmufl, ILD27FL, filocrfl, usubjid, aai2effl, PDP214FL, ILD214FL, CDRMUPFL,
adt, dvstdt
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    from tpop;
quit;

proc sql noprint;
  select bign into :n1 - :n2
  from (select count(distinct usubjid) as bign, trt01pn
  from dsin
  group by trt01pn)
  order by trt01pn;
quit;

%let n1 = &n1.;
%let n2 = &n2.;

%put &n1 &n2.;

/*** Subjects at Risk ****/

proc sql;
  create table riskp as select distinct usubjid, trt01pn, trt01p, aval
  from dsin
  where PDRMUPFL = "N" and paramcd in ("ST27PD") and aval > 0;
quit;

proc sql;
  create table n2 as select count(distinct usubjid) as n2, trt01pn
  from riskp
  group by trt01pn
  order by trt01pn;
quit;

/***** Events (n1) ****/

proc sql;
  create table evnts as select distinct usubjid, param, avalc, trt01pn
  from dsin
  where paramcd in ("C19ONST") and upcase(ILD27FL) = "Y" and upcase(FILOCRFL) = "Y" and ((not
missing(DVSTDT) and adt <= DVSTDT) or missing(DVSTDT))
  and usubjid in (select distinct usubjid from riskp)
  order by usubjid;
quit;

proc sql;
  create table evtn as select count(distinct usubjid) as smln, trt01pn
  from evnts
  group by trt01pn
  order by trt01pn;
quit;

/**** Make sure All treatment arms are present in EVTN dataset (with 0 cases) *****/
proc sql noprint;
  create table trt_u as
  select distinct trt01pn
  from dsin
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    order by trt01pn;
quit;

data evtn;
  merge evtn (in=a) trt_u (in=b);
  by trt01pn;
  if b;
  if missing(smln) then smln = 0;
run;

/*** Surveillance Time ****/

proc sql;
  create table st as select distinct usubjid, aval, trt01pn, trt01p, paramcd
  from dsin
  where paramcd in ("ST27PD") and
  usubjid in (select distinct usubjid from riskp);
quit;

proc sql;
  create table riskn as select a.*, b.ptyrs, pty
  from  n2 a inner join
  (select (sum(aval)/365.25/1000) as ptyrs, sum(aval)/365.25 as pty, trt01pn
  from st group by trt01pn) b on a.trt01pn = b.trt01pn;
quit;

proc sql;
  create table pt as select strip(put(a.smln,best.)) as evtn, b.*, smln/ptyrs as ir,
  a.smln, (put(ptyrs, 7.3) || " (" || strip(put(n2,best.))) || ")" as ptyb
  from evtn a inner join
  riskn b on a.trt01pn = b.trt01pn;
quit;

/**** Total cases ****/
proc sql noprint;
  select sum(smln) into :ncases
  from pt;
quit;

%let ncases = &ncases.;

/***** Cases in Vacination Group ****/

proc sql noprint;
   select smln into :nv1-:nv2 from pt;
quit;

%let nv1 = &nv1;
%let nv2 = &nv2;
%let ncases = &ncases;
%let ve = 0.3;

%put No. of Cases in Vacination group are &nv1.;
%put Total No. of Cases in the trial are &ncases.;
```

```
proc transpose data = pt out = tr prefix = trt;
  var ptyrs;
  id trt01pn;
run;

data tr;
 set tr;
 *IRR=trt8/trt9;
 n_p = &ncases - &nv1.;
 r = trt8/trt9;
 P = R*(1-&VE)/(1+R*(1-&VE));
 IR_V=&nv1/trt8;
 IR_P=n_p/trt9;
 alpha = 0.05;
 length VE lcl ucl $25.;
 VE=strip(put(100*(1-IR_V/IR_P),7.1));
 pr = put(CDF('BETA',p,0.700102+&nv1,1+&ncases-&nv1),7.4);
 pr_n = CDF('BETA',p,0.700102+&nv1,1+&ncases-&nv1);
 qh_theta = quantile('BETA',0.975,0.700102+&nv1,1+&ncases-&nv1);
 ql_theta = quantile('BETA',0.025,0.700102+&nv1,1+&ncases-&nv1);
 QH = round (100*(R - qL_theta*(R+1))/(R*(1-qL_theta)), 0.01);
 QL = round (100*(R - qH_theta*(R+1))/(R*(1-qH_theta)), 0.01);

 *** Use Clopper-Pearson Method to display CI ****;
 fu = finv( 1- alpha/2, 2*(&nv1.+1), 2*N_P);
 ucl_pi = (&nv1 +1)*fu/(N_P + (&nv1.+1)*fu);
 fl = finv(1-alpha/2, 2*(N_P+1), 2*&nv1.);
 if &nv1 = 0 then lcl_pi = 0;
 else lcl_pi = &nv1./(&nv1. + fl*(N_P+1));
 ucl_theta = ucl_pi/(r*(1-ucl_pi));
 lcl_theta = lcl_pi/(r*(1-lcl_pi));
 qu = 100*(1 - lcl_theta);
 ql = 100*(1 - ucl_theta);
 if not missing(ql) then lcl = strip(put(ql,8.1));
 else lcl = "-(*ESC*){unicode 221e}";
 if not missing(qu) then ucl = strip(put(qu,8.1));
 else ucl = 'NE';
 vci = "(" || strip(lcl) || ", " || strip(ucl) || ")";
 **** END ****;

 text = "First COVID-19 occurrence from 7 days after Dose 2";
 /**** If probablity is 0 then show <0.0001' and if its 1 then then show >0.9999 *****/
 if pr_n < 0.0001 then pr = '<0.0001';
 else if pr_n > 0.9999 then pr = '>0.9999';
 /**** If VE is missing then show Infinity symbol ****/
 if strip(ve) = '.' then do; ve = "-(*ESC*){unicode 221e}"; vci = "(NA, NA)"; end;
run;

proc transpose data = pt out = trn prefix = trtn;
  var evtn;
  id trt01pn;
run;
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```
proc transpose data = pt out = try prefix = trty;
  var ptyb;
  id trt01pn;
run;

proc sql;
  create table final as select a.*, b.*, c.*
  from trn (drop = _name_) a,
  try (drop = _name_) b,
  tr (drop = _name_) c;
quit;

********* Set up Report *******;
ods escapechar="~";

ods html file="&outtable.";

title1 "Vaccine Efficacy (*ESC*){unicode 2013} First COVID-19 Occurrence From 7 Days After Dose 2";
title2 "(*ESC*){unicode 2013} Blinded Placebo-Controlled Follow-up Period";
title3 "(*ESC*){unicode 2013} Subjects 12 Through 15 Years of Age and With or Without Evidence of Infection Prior
to 7 Days After Dose 2";
title4 "(*ESC*){unicode 2013} Evaluable Efficacy (7 Days) Population";
footnote1 "Abbreviation: VE = vaccine efficacy.";
footnote2 "a.(*ESC*){nbspace 5}N = number of subjects in the specified group. ~nb.(*ESC*){nbspace 5}n1 = Number
of subjects meeting the endpoint definition.";
footnote3 "c.(*ESC*){nbspace 5}Total surveillance time in 1000 person-years for the given endpoint across all subjects
within each group at risk for the endpoint. Time period for COVID-19 case accrual is from 7 days after Dose 2 to the
end of the surveillance period.";
footnote4 "d.(*ESC*){nbspace 5}n2 = Number of subjects at risk for the endpoint.";
footnote5 "e.(*ESC*){nbspace 5}Confidence interval (CI) for VE is derived based on the Clopper and Pearson method
adjusted for surveillance time.";
;

proc report data = final nowd headline headskip split = "*" style(report)=[];
column (text ("Vaccine Group (as Randomized)~{line}" ("BNT162b2 (30 ~{unicode 03BC}g)*(N~{super a}=&n1.)"
trtn8 trty8) ("Placebo*(N~{super a}=&n2.)" trtn9 trty9)) ve vci);
define text / "Efficacy Endpoint" flow style(header)=[just=l] style(column)=[cellwidth=3in just=l];
define trtn8 / " n1~{super b}" style(column)=[cellwidth=0.8in just=c];
define trty8 / "Surveillance*Time~{super c} (n2~{super d})" style(column)=[cellwidth=1.5in just=c];
define trtn9 / " n1~{super b}" style(column)=[cellwidth=0.8in just=c];
define trty9 / "Surveillance*Time~{super c} (n2~{super d})" style(column)=[cellwidth=1.5in just=c];
define ve / "  VE (%)" style(column)=[cellwidth=0.5in just=c];
define vci / " (95% CI~{super e})" style(column)=[cellwidth=0.5in just=c];
run;

ods HTML close;

proc printto;
run;
```