```
*******************************************************************************
****************;
** Program Name   : adc19ef-ve-cov-7pd2-p-wo-sg-eval.sas                    **;
** Date Created   : 17Nov2021                                          **;
** Programmer Name: (b) (4), (b)                                    **;
**                  (6)                                                **;
** Purpose        : Create adc19ef-ve-cov-7pd2-p-wo-sg-eval.html          **;
** Input data     : ie, adsl, adc19ef                             **;
** Output data    : adc19ef-ve-cov-7pd2-p-wo-sg-eval.html              **;
*******************************************************************************
****************;
%let prot=/Volumes/app/cdars/prod/sites/cdars4/prjC459/nda2_unblinded_esub/sbla1215_esub_adam/saseng/cdisc3_0;
libname dataprot
"/Volumes/app/cdars/prod/sites/cdars4/prjC459/nda2_unblinded_esub/sbla1215_esub_sdtm/saseng/cdisc3_0/data/sdtm"

       access=readonly;
libname datvprot "&prot./data_vai" access=readonly;
%let codename=adc19ef-ve-cov-7pd2-p-wo-sg-eval;
options mprint symbolgen mlogic SPOOL nocenter missing=" ";

proc datasets library=WORK kill nolist nodetails;
quit;

%let outlog=&prot./analysis/eSUB/logs/&codename..log;
%let outtable=&prot./analysis/eSUB/output/&codename..html;

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

*Formating;

proc format;
    value grpfmt 0="First COVID-19 occurrence from 7 days after Dose 2"
        1="(*ESC*){nbspace 10}" 2="Overall" 3="(*ESC*){nbspace 10}" 4="Sex"
        5="(*ESC*){nbspace 4}Male" 6="(*ESC*){nbspace 4}Female"
        7="(*ESC*){nbspace 10}" 8="Race" 9="(*ESC*){nbspace 4}White"
        10="(*ESC*){nbspace 4}Black or African American"
        11="(*ESC*){nbspace 4}All others"
        12="(*ESC*){nbspace 7}American Indian or Alaska native"
        13="(*ESC*){nbspace 7}Asian"
        14="(*ESC*){nbspace 7}Native Hawaiian or other Pacific Islander"
        15="(*ESC*){nbspace 7}Multiracial" 16="(*ESC*){nbspace 7}Not reported"
        17="(*ESC*){nbspace 10}" 18="Ethnicity"
        19="(*ESC*){nbspace 4}Hispanic/Latino"
        20="(*ESC*){nbspace 4}Non-Hispanic/non-Latino"
        21="(*ESC*){nbspace 4}Not reported" 22="(*ESC*){nbspace 10}" 23="Country"
        24="(*ESC*){nbspace 4}USA" 25="(*ESC*){nbspace 10}"
        26="Comorbidities(*ESC*){super f}" 27="(*ESC*){nbspace 4}Yes"
        28="(*ESC*){nbspace 4}No" 29="(*ESC*){nbspace 10}" 30="Obese(*ESC*){super g}"
        31="(*ESC*){nbspace 4}Yes" 32="(*ESC*){nbspace 4}No" 33="(*ESC*){nbspace 10}"
        34="Prior SARS-CoV-2 Status"
        35="(*ESC*){nbspace 4}Positive at baseline(*ESC*){super h}"
        36="(*ESC*){nbspace 8}Positive N-binding only"
        37="(*ESC*){nbspace 8}Positive NAAT only"
```

```
                38="(*ESC*){nbspace 8}Positive NAAT and N-binding" 39="(*ESC*){nbspace 4}Negative at baseline but
positive prior to 7 days after Dose 2(*ESC*){super i}"
                40="(*ESC*){nbspace 4}Negative prior to 7 days after Dose 2(*ESC*){super j}"
                41="(*ESC*){nbspace 4}Unknown";
run;


/*** Population Flag **/
proc sql;
        create table popf as select distinct usubjid, evaleffl, trt01pn, trt01p,
                NIGV1FL, NAATNFL from datvprot.adsl where evaleffl='Y' and PHASEN ne 1 and
                HIVFL='N' and agegr1n=1 order by usubjid;
quit;

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

***** Derivation for flag needed in last block  - START *******;
****get Exclusion Criterion 5 from IE dataset****;

proc sort data=dataprot.ie out=ie (keep=usubjid IESTRESC) nodupkey;
        by usubjid;
        where IETESTCD="EX05A05" and IESTRESC="Y";
run;

***get Positive NAAT at unscheduled visit up-to 7/14 days after Dose2***;

data naat_un1;
        set datvprot.adc19ef;

        if paramcd="C19ONST" and avalc="POS" and vax101dt ^=. and vax102dt ^=. and
                vax101dt < adt < sum(vax102dt, 7);
        NAAT_POS_UN="Y";
        keep usubjid NAAT_POS_UN;
run;

proc sort;
        by usubjid;
run;

data naat_un2;
        set datvprot.adc19ef;

        if paramcd="NAATRAD" and avalc="POS" and vax101dt ^=. and vax102dt ^=. and
                vax101dt < adt < sum(vax102dt, 7);
        NAAT_POS_UN="Y";
        keep usubjid NAAT_POS_UN;
run;

proc sort;
        by usubjid;
run;

data naat_un3;
```

```
        set datvprot.adc19ef;

        if paramcd="RTCOV2NS" and avalc="POS" and vax101dt ^=. and vax102dt ^=. and
             vax101dt < adt < sum(vax102dt, 7);
     NAAT_POS_UN="Y";
        keep usubjid NAAT_POS_UN;
run;

proc sort;
        by usubjid;
run;

data naat_un;
        merge naat_un1 (in=a) naat_un2 (in=b) naat_un3 (in=c);
        by usubjid;

        if a or b or c;
run;

proc sort nodupkey;
        by usubjid;
run;

data tpop;
        merge adc19ef (in=a) popf (in=b) naat_un ie;
        by usubjid;

        if a*b;

        if vrblngfl='N' or crd1ngfl='N' or C19ILHFL="Y" or IESTRESC='Y' then
             do;
                    sero_bl="POS";
                    ord=1;
             end;
        else if PDP27FL='Y' then
             do;
                    sero_bl="NEG";
                    ord=3;
             end;
        else if vrblngfl='Y' and crd1ngfl='Y' and (NAAT_POS_UN="Y" or crd2ngfl='N')
             then
                    do;
                    sero_bl="NEU";
                    ord=2;
             end;

        if sero_bl="" then
             do;
                    sero_bl="UNK";
                    ord=4;
             end;
run;

***** Derivation for flag needed in last block  - END *******;
```

```
/***** Total Population ****/
proc sql;
    create table dsin as select distinct subjid, trt01pn, trt01p, paramn, paramcd,
        param, pdrmupfl, adt, dvstdt, NIGV1FL, NAATNFL, aval, avalc, evaleffl,
        PDP27FL, pdrmufl, ILD27FL, filocrfl, usubjid, PDP214FL, ILD214FL, sero_bl,
        ord from tpop order by usubjid;
quit;

proc sql noprint;
    select bign into :n1 - :n2 from (select count(distinct usubjid) as bign,
        trt01pn from dsin where PDP27FL="Y" group by trt01pn) order by trt01pn;
quit;

/**** Read Subgroup Variables ****/
proc sql;
    create table adsl as select a.*, b.subjid, b.arace, b.aracen, b.sex, b.agegr1,
        b.agegr1n, b.racialdn, b.raciald, b.ethnic, b.ethnicn, b.country, b.age,
        b.agegr2, b.agegr2n, b.agetr01, b.bmicat, b.obesefl, b.COMBODFL, b.BMICATN,
        case when 12 <=b.age <=15 then 1
        /*when 16 <= b.age <= 17 then 2*/
        when 16 <=b.age <=55 then 3 else 4 end as agen from popf a inner join
        datvprot.adsl b on a.usubjid=b.usubjid order by usubjid;
quit;

data dsn;
    merge dsin (in=a) adsl (in=b);
    by usubjid;

    if a*b;

    if /*(BMICATN = 4 and AGETR01 >=16) or*/
    OBESEFL="Y" then
        obese="Y";
    else
        obese="N";

    if COMBODFL='Y' or /*(BMICATN = 4 and AGETR01 >=16) or*/
    OBESEFL="Y" then
        comorbid="Y";
    else
        comorbid="N";
run;

%macro sbgrp (cond=, ord=, out=, grp=);
    data dsin;
        set dsn;
        where &cond.;
    run;

    /*** Subjects at Risk ****/
    proc sql;
        create table riskp as select distinct usubjid, trt01pn, trt01p, aval from
            dsin where pdrmupfl="N" and PDP27FL="Y" and paramcd in ("ST27PD") and
```

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          aval > 0;
quit;

/*** If there are no subjects in a subgroup, populate 0 ****/
proc sql noprint;
      select count(*) into :tobs from riskp;
quit;

%put &tobs.;

%if &tobs > 0 %then
      %do;

            data dmny;
                  do trt01pn=8 to 9;
                        output;
                  end;
            run;

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

            data n2;
                  merge dmny (in=a)n2;
                  by trt01pn;

                  if a;

                  if missing(n2) then
                        n2=0;
            run;

            /***** 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 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;

            data evtn;
                  merge dmny (in=a) evtn;
                  by trt01pn;

                  if a;

                  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 from n2 a inner join
 (select (sum(aval)/365.25/1000) as ptyrs, trt01pn from st group by trt01pn) b
                      on a.trt01pn=b.trt01pn;
          quit;

          data riskn;
                merge dmny (in=a) riskn;
                by trt01pn;

                if a;

                if missing(ptyrs) then
                      ptyrs=0;

                if missing(n2) then
                      n2=0;
          run;

          proc sql;
                create table &out._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 left join riskn b on
                      a.trt01pn=b.trt01pn;
          quit;

          /**** Total cases ****/
          proc sql noprint;
                select sum(smln) into :ncases from &out._pt;
          quit;

          %let ncases = &ncases.;

          /***** Cases in Vacination Group ****/
          proc sql noprint;
                select smln into :nv1-:nv2 from &out._pt;
          quit;

          %let alpha=0.05;
          %let nv1 = &nv1;
          %let nv2 = &nv2;
          %let ncases = &ncases;
          %put No. of Cases in Vacination group are &nv1.;
          %put Total No. of Cases in the trial are &ncases.;
```

```
proc transpose data=&out._pt out=&out._tr prefix=trt;
    var ptyrs;
    id trt01pn;
run;

%put &nv1 &nv2;

data &out._tr;
    set &out._tr;

    if &nv1 > 0 or &nv2 > 0 then
        do;
            r=trt8/trt9;
            n_p=&ncases - &nv1.;
            ir_v=&nv1/trt8;
            ir_p=n_p/trt9;
            alpha=&alpha.;
            length ve lcl ucl $25.;
            VE=strip(put(100*(1-ir_v/ir_p), 10.1));
            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);

            /* vci = "(" || strip(put(ql,8.1)) || ", " || strip(put(qu,8.1)) || ")"; */
            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;
    else
        do;
            ve="NE";
            call missing(pr, vci);
        end;
    grp=&grp;
    ord=&ord;
    *drop ql qh irr qu_:;
```

```
            if strip(ve)='.' then
                do;
                    ve="-(*ESC*){unicode 221e}";
                    vci="(NA, NA)";
                end;
        run;

        proc transpose data=&out._pt out=trn prefix=trtn;
            var evtn;
            id trt01pn;
        run;

        proc transpose data=&out._pt out=try prefix=trty;
            var ptyb;
            id trt01pn;
        run;

        proc sql;
            create table f_&out. as select a.*, b.*, c.* from trn (drop=_name_) a,
                try (drop=_name_) b, &out._tr (drop=_name_) c;
        quit;

    %end;
%else
    %do;

        data f_&out.;
            length ve vci trtn8 trtn9 $50 trty8 trty9 $100;
            grp=&grp;
            ord=&ord.;
            ve="NE";
            vci=" ";
            trtn8="0";
            trtn9="0";
            trty8=" 0.00 (0)";
            trty9=" 0.00 (0)";
        run;

    %end;
%mend sbgrp;

%sbgrp (cond=%str(), ord=0, grp=1, out=fst);
**added to display overall count in first row***;
%sbgrp (cond=%str(), ord=2, grp=1, out=ovr);
*** Overall ***;
%sbgrp (cond=%str(sex in ('M')), ord=5, grp=2, out=sx1);
*** Male ***;
%sbgrp (cond=%str(sex in ('F')), ord=6, grp=2, out=sx2);
*** Female ***;
%sbgrp (cond=%str(aracen in (1)), ord=9, grp=3, out=rc1);
*** White ***;
%sbgrp (cond=%str(aracen in (2)), ord=10, grp=3, out=rc2);
*** Black or Afri Amer ***;
%sbgrp (cond=%str(aracen not in (1,2)), ord=11, grp=3, out=rc8);
```

```sas
*** All Others ***;
%sbgrp (cond=%str(aracen in (3)), ord=12, grp=3, out=rc3);
*** American ***;
%sbgrp (cond=%str(aracen in (4)), ord=13, grp=3, out=rc4);
*** Asian ***;
%sbgrp (cond=%str(aracen in (5)), ord=14, grp=3, out=rc5);
*** Hawaii ***;
%sbgrp (cond=%str(aracen in (6)), ord=15, grp=3, out=rc6);
*** Multi ***;
%sbgrp (cond=%str(aracen in (7)), ord=16, grp=3, out=rc7);
*** Not reported ***;
%sbgrp (cond=%str(ethnicn in (1)), ord=19, grp=4, out=et1);
***  Hispanic/Latino ***;
%sbgrp (cond=%str(ethnicn in (2)), ord=20, grp=4, out=et2);
*** Non-Hispanic/non-Latino ***;
%sbgrp (cond=%str(ethnicn in (3)), ord=21, grp=4, out=et3);
*** Not reported ***;
%sbgrp (cond=%str(country in ("USA")), ord=24, grp=5, out=ct6);
*** USA ***;
%sbgrp (cond=%str(OBESE="Y"), ord=27, grp=6, out=ob1);
*** Obese="Yes" ***;
%sbgrp (cond=%str(OBESE="N"), ord=28, grp=6, out=ob2);
*** Obese="No" ***;
%sbgrp (cond=%str(comorbid="Y"), ord=31, grp=7, out=cm1);
*** Comorbidities="Yes"***;
%sbgrp (cond=%str(comorbid="N"), ord=32, grp=7, out=cm2);
*** Comorbidities="No" ***;
%sbgrp (cond=%str(sero_bl in ("POS")), ord=35, grp=8, out=sr1);
*** Positive at baseline ***;
%sbgrp (cond=%str(sero_bl in ("POS") and (NIGV1FL = "N" and NAATNFL ne "N")),
     ord=36, grp=8, out=sr11);
*** Positive N-binding only ***;
%sbgrp (cond=%str(sero_bl in ("POS") and (NIGV1FL ne "N" and NAATNFL = "N")),
     ord=37, grp=8, out=sr12);
*** Positive NAAT only ***;
%sbgrp (cond=%str(sero_bl in ("POS") and (NIGV1FL = "N" and NAATNFL = "N")),
     ord=38, grp=8, out=sr13);
*** Positive NAAT and N-binding ***;
%sbgrp (cond=%str(sero_bl in ("NEU")), ord=39, grp=8, out=sr2);
*** Negative at baseline but positive prior to 7 days after Dose 2 ***;
%sbgrp (cond=%str(sero_bl in ("NEG")), ord=40, grp=8, out=sr3);
*** Negative prior to 7 days after Dose ***;
%sbgrp (cond=%str(sero_bl in ("UNK")), ord=41, grp=8, out=sr4);
*** Unknown ***;

data final;
     length vci $100. trtn8 trtn9 $50.;
     set f_:;
run;

proc sort data=final;
     by ord grp;
run;
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```
data dummy;
     do ord=0 to 41;
          output;
     end;
run;

data dummy;
     set dummy;

     if 0<=ord<=2 then
          grp=1;

     if 3<=ord<=6 then
          grp=2;

     if 7<=ord<=16 then
          grp=3;

     if 17<=ord<=21 then
          grp=4;

     if 22<=ord<=24 then
          grp=5;

     if 25<=ord<=38 then
          grp=6;

     if 29<=ord<=32 then
          grp=7;

     if 33<=ord<=41 then
          grp=8;
run;

proc sort;
     by ord grp;
run;

data rf;
     merge dummy (in=a) final;
     by ord grp;

     if a;
     text=put(ord, grpfmt.);

     if strip(trtn8)='0' and strip(trtn9)='0' then
          delete;

     if grp in (8) then
          delete;

     if ord=0 then
          do;
               trtn8='';
```

```
            trty8=";
            trtn9=";
            trty9=";
            ve=";
            vci=";
        end;
run;

/* Output report */
ods escapechar="~";
ods html file="&outtable.";
title1 "Vaccine Efficacy (*ESC*){unicode 2013} First COVID-19 Occurrence From 7 Days After Dose 2, by
Subgroup";
title2 "(*ESC*){unicode 2013} Blinded Placebo-Controlled Follow-up Period";
title3 "(*ESC*){unicode 2013} Subjects 12 Through 15 Years of Age and Without Evidence of Infection Prior to 7
Days After Dose 2";
title4 "(*ESC*){unicode 2013} Evaluable Efficacy (7 Days) Population";
footnote1 "Abbreviations: N-binding = SARS-CoV-2 nucleoprotein(*ESC*){unicode 2013}binding; NAAT = nucleic
acid amplification test; ~nSARS-CoV-2 = severe acute respiratory syndrome coronavirus 2; VE = vaccine efficacy.";
footnote2 "Note: Subjects who had no serological or virological evidence (prior to 7 days after receipt of the last dose)
of past SARS-CoV-2 infection (ie, N-binding antibody [serum] negative at Visit 1 and SARS-CoV-2 not detected by
NAAT [nasal swab] at Visits 1 and 2, and had negative NAAT (nasal swab) at any unscheduled visit prior to 7 days
after Dose 2) were included in the analysis.";
footnote3 "a.(*ESC*){nbspace 5}N = number of subjects in the specified group. ~nb.(*ESC*){nbspace 5}n1 = Number
of subjects meeting the endpoint definition.";
footnote4 "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.";
footnote5 "d.(*ESC*){nbspace 5}n2 = Number of subjects at risk for the endpoint. ~ne.(*ESC*){nbspace 5}Confidence
interval (CI) for VE is derived based on  the Clopper and Pearson method adjusted for surveillance time.";
footnote6 "f.(*ESC*){nbspace 5}Comorbidities are defined as having at least one of the Charlson comorbidity index
category or obesity (BMI (*ESC*){unicode 2265}95(*ESC*){super th} percentile).";
footnote7 "g.(*ESC*){nbspace 5}Obese is defined as BMI (*ESC*){unicode 2265}95(*ESC*){super th} percentile
from the growth chart. Refer to the CDC growth charts at
https://www.cdc.gov/growthcharts/html_charts/bmiagerev.htm.";

proc report data=rf nowd headline headskip split="*"
        style(report)=[borderwidth=10];
    column grp ord (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 ord / display noprint;
    define grp / display noprint;
    define text / "Efficacy Endpoint*~{nbspace 5}Subgroup" 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 markup close;
ods HTML close;

proc printto;
run;
```