ptg covid analysis

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relevant code

```
################################
### ptg main analysis script
################################
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
## v dplyr     1.1.4     v readr     2.1.5
## v forcats   1.0.0     v stringr   1.5.1
## v ggplot2   3.5.1     v tibble    3.2.1
## v lubridate 1.9.3     v tidyr     1.3.1
## v purrr     1.0.2
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become error
```

```
library(readxl)
library(metafor)
```

```
## Loading required package: Matrix
##
## Attaching package: 'Matrix'
##
## The following objects are masked from 'package:tidyr':
##
##     expand, pack, unpack
##
## Loading required package: metadat
## Loading required package: numDeriv
##
## Loading the 'metafor' package (version 4.6-0). For an
## introduction to the package please type: help(metafor)
```

```
library(psych)
```

```
##
## Attaching package: 'psych'
##
## The following objects are masked from 'package:ggplot2':
##
##     %+%, alpha
```

```r
library(kableExtra)
```

```
##
## Attaching package: 'kableExtra'
##
## The following object is masked from 'package:dplyr':
##
##     group_rows
```

```r
setwd(dirname(rstudioapi::documentPath()))

## load data
shortlist = read_excel('effect_sizes_and_moderators.xlsx')
## look at how many studies uses PTGI
shortlist %>% group_by(`scale type`) %>% count() # 20 PTGI and 10 PTGI-SF
```

```
## # A tibble: 2 x 2
## # Groups:   scale type [2]
##   `scale type`     n
##   <chr>        <int>
## 1 PTGI            54
## 2 PTGI-SF         17
```

```r
## we can do normalization or we can perform separate analysis for these two types of studies
## check the sample size
sum(shortlist$`sample size`) ## overall
```

```
## [1] 65704
```

```r
PTGI_dat = shortlist %>% filter(`scale type` == 'PTGI')
PTGISF_dat = shortlist %>% filter(`scale type` != 'PTGI')

#################################################################
#################################################################
#### stretch PTGI-SF
PTGISF_transformed = PTGISF_dat %>% mutate(`effect size` = `effect size` / 10 * 21) %>%
  mutate(sd = sqrt(sd^2 * 2.1^2))
PTGISF_transformed
```

```
## # A tibble: 17 x 11
##    Source      `scale type` `effect size`    sd `sample size` Anxiety Depression
##    <chr>       <chr>                <dbl> <dbl>         <dbl>   <dbl>      <dbl>
##  1 Adjorlolo ~ PTGI-SF               46.7  10.6           381       1          1
##  2 Chen et al~ PTGI-SF               58.8  24.2         12596       0          0
##  3 Lewis et a~ PTGI-SF               26.5  23.1          1424       0          0
##  4 Ulset & So~ PTGI-SF               45.4  14.3         12686       0          1
##  5 Vazquez et~ PTGI-SF               76.7  16.0          1951       1          0
##  6 Yeung et a~ PTGI-SF               46.0  20.4          1510       0          0
##  7 El-Khoury ~ PTGI-SF               63.7  24.5           252       0          0
##  8 Tu et al. ~ PTGI-SF               98.3  25.1           290       1          1
##  9 Barnicot e~ PTGI-SF               42.7  22.9           854       1          1
## 10 Azman et a~ PTGI-SF               84    45.4           152       1          1
## 11 Deitz (202~ PTGI-SF               48.3  10.7           436       1          0
## 12 Gaboardi e~ PTGI-SF               76.0  25.6           295       0          0
## 13 Moreno-Jim~ PTGI-SF               86.3  17.6           172       1          0
## 14 Uziel et a~ PTGI-SF               37.4  21.6           364       1          1
```

```
## 15 Veronese e~ PTGI-SF                76.0  18.9            441       0           0
## 16 Zeng et al~ PTGI-SF                52.9  19.9           2267       1           1
## 17 Aggar et a~ PTGI-SF                45.4  24.6            767       1           1
## # i 4 more variables: Coping <dbl>, `Sprituality/Religion` <dbl>, PTSD <dbl>,
## #   `Social Support` <dbl>
```

```
PTGI = rbind(PTGI_dat, PTGISF_transformed)

head(PTGI)
```

```
## # A tibble: 6 x 11
##   Source       `scale type` `effect size`    sd `sample size` Anxiety Depression
##   <chr>        <chr>                <dbl> <dbl>         <dbl>   <dbl>      <dbl>
## 1 Arnout and ~ PTGI                  65.2  17.9           365       1          1
## 2 Chasson et ~ PTGI                  55.8  19.1           916       1          0
## 3 Chen & Tang~ PTGI                  64.8  10.4           422       0          0
## 4 Gul (2023)   PTGI                  45.6  11.7           300       0          0
## 5 Kalaitzaki ~ PTGI                  47.7  24.6           352       1          1
## 6 Lau et al. ~ PTGI                  53.1  17.2           327       0          0
## # i 4 more variables: Coping <dbl>, `Sprituality/Religion` <dbl>, PTSD <dbl>,
## #   `Social Support` <dbl>
```

```
### start analysis with all the studies (PTGI gets successfully transformed)
PTGI_num = sum((PTGI_dat$`sample size` - 1) * PTGI_dat$sd^2)
PTGI_denom = sum(PTGI_dat$`sample size`) - length(PTGI_dat$`sample size`)
PTGI_sp = PTGI_num / PTGI_denom
PTGI_pooled_sd = sqrt(PTGI_sp)
PTGI_pooled_sd
```

```
## [1] 27.56923
```

```
cutoff = 45
PTGI_g = PTGI %>%
  mutate(PTGI_num = (sum(`sample size`) - 1) * sd^2) %>%
  mutate(PTGI_denom = sum(`sample size`) - length(`sample size`)) %>%
  mutate(PTGI_pooled_sd = sqrt(PTGI_num / PTGI_denom)) %>%
  mutate(g = (`effect size` - cutoff) / PTGI_pooled_sd) %>%
  mutate(v_g = 2 * (1 - 0) / (`sample size`) + g^2 / (2 * (`sample size` - 1)))

## now we have the ingredient to perform meta analysis
PTGI_g[,c('g', 'v_g')]
```

```
## # A tibble: 71 x 2
##          g     v_g
##      <dbl>   <dbl>
##  1 1.12   0.00722
##  2 0.564  0.00236
##  3 1.90   0.00901
##  4 0.0487 0.00667
##  5 0.111  0.00570
##  6 0.472  0.00646
##  7 2.38   0.0193
##  8 2.38   0.0182
##  9 0.0709 0.00677
## 10 0.120  0.0114
## # i 61 more rows
```

```r
## we run intercept only model for main analysis (this would be random intercept model)
main_analysis_model_PTGI = rma(g ~ 1, vi = v_g, data = PTGI_g)
main_analysis_model_PTGI
```

```
##
## Random-Effects Model (k = 71; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 30.1521 (SE = 5.1075)
## tau (square root of estimated tau^2 value):      5.4911
## I^2 (total heterogeneity / total variability):   99.99%
## H^2 (total variability / sampling variability):  10435.83
##
## Test for Heterogeneity:
## Q(df = 70) = 15402.8689, p-val < .0001
##
## Model Results:
##
## estimate      se    zval    pval   ci.lb   ci.ub
##   2.0335  0.6524  3.1171  0.0018  0.7549  3.3122  **
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
#################################################################
## Subgroup analysis
#################################################################
## PTSD
PTGI_PTSD = rma(g ~ PTSD, vi = v_g, data = PTGI_g)
PTGI_PTSD
```

```
##
## Mixed-Effects Model (k = 71; tau^2 estimator: REML)
##
## tau^2 (estimated amount of residual heterogeneity):     30.2963 (SE = 5.1691)
## tau (square root of estimated tau^2 value):             5.5042
## I^2 (residual heterogeneity / unaccounted variability): 99.99%
## H^2 (unaccounted variability / sampling variability):   9124.20
## R^2 (amount of heterogeneity accounted for):            0.00%
##
## Test for Residual Heterogeneity:
## QE(df = 69) = 14341.3738, p-val < .0001
##
## Test of Moderators (coefficient 2):
## QM(df = 1) = 0.7806, p-val = 0.3770
##
## Model Results:
##
##          estimate      se     zval    pval    ci.lb   ci.ub
## intrcpt    2.3709  0.7571   3.1314  0.0017   0.8869  3.8548  **
## PTSD      -1.3273  1.5023  -0.8835  0.3770  -4.2717  1.6172
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
### more subgroup analysis
PTGI_Anxiety = rma(g ~ Anxiety, vi = v_g, data = PTGI_g)
PTGI_Anxiety
```

```
##
## Mixed-Effects Model (k = 71; tau^2 estimator: REML)
##
## tau^2 (estimated amount of residual heterogeneity):     29.1370 (SE = 4.9716)
## tau (square root of estimated tau^2 value):             5.3979
## I^2 (residual heterogeneity / unaccounted variability): 99.99%
## H^2 (unaccounted variability / sampling variability):   9420.50
## R^2 (amount of heterogeneity accounted for):            3.37%
##
## Test for Residual Heterogeneity:
## QE(df = 69) = 15352.9902, p-val < .0001
##
## Test of Moderators (coefficient 2):
## QM(df = 1) = 3.3907, p-val = 0.0656
##
## Model Results:
##
##          estimate      se     zval    pval    ci.lb   ci.ub
## intrcpt    2.9308  0.8060   3.6361  0.0003   1.3510  4.5106  ***
## Anxiety   -2.4503  1.3307  -1.8414  0.0656  -5.0584  0.1578    .
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
PTGI_Depression = rma(g ~ Depression, vi = v_g, data = PTGI_g)
PTGI_Depression
```

```
##
## Mixed-Effects Model (k = 71; tau^2 estimator: REML)
##
## tau^2 (estimated amount of residual heterogeneity):     29.6577 (SE = 5.0603)
## tau (square root of estimated tau^2 value):             5.4459
## I^2 (residual heterogeneity / unaccounted variability): 99.99%
## H^2 (unaccounted variability / sampling variability):   8940.61
## R^2 (amount of heterogeneity accounted for):            1.64%
##
## Test for Residual Heterogeneity:
## QE(df = 69) = 12723.7079, p-val < .0001
##
## Test of Moderators (coefficient 2):
## QM(df = 1) = 2.1683, p-val = 0.1409
##
## Model Results:
##
##             estimate      se     zval    pval    ci.lb   ci.ub
## intrcpt       2.5680  0.7421   3.4602  0.0005   1.1134  4.0225  ***
## Depression   -2.2311  1.5152  -1.4725  0.1409  -5.2007  0.7386
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
PTGI_Support = rma(g ~ `Social Support`, vi = v_g, data = PTGI_g)
PTGI_Support
```

```
##
## Mixed-Effects Model (k = 71; tau^2 estimator: REML)
##
## tau^2 (estimated amount of residual heterogeneity):     30.3792 (SE = 5.1830)
## tau (square root of estimated tau^2 value):             5.5117
## I^2 (residual heterogeneity / unaccounted variability): 99.99%
## H^2 (unaccounted variability / sampling variability):   9015.41
## R^2 (amount of heterogeneity accounted for):            0.00%
##
## Test for Residual Heterogeneity:
## QE(df = 69) = 14813.9908, p-val < .0001
##
## Test of Moderators (coefficient 2):
## QM(df = 1) = 0.6856, p-val = 0.4077
##
## Model Results:
##
##                   estimate      se    zval    pval    ci.lb   ci.ub
## intrcpt             1.7302  0.7506  2.3052  0.0212   0.2591  3.2013  *
## `Social Support`    1.2717  1.5359  0.8280  0.4077  -1.7386  4.2820
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
PTGI_Coping = rma(g ~ `Coping`, vi = v_g, data = PTGI_g)
PTGI_Coping
```

```
##
## Mixed-Effects Model (k = 71; tau^2 estimator: REML)
##
## tau^2 (estimated amount of residual heterogeneity):     28.8631 (SE = 4.9249)
## tau (square root of estimated tau^2 value):             5.3724
## I^2 (residual heterogeneity / unaccounted variability): 99.99%
## H^2 (unaccounted variability / sampling variability):   9348.72
## R^2 (amount of heterogeneity accounted for):            4.28%
##
## Test for Residual Heterogeneity:
## QE(df = 69) = 14938.3057, p-val < .0001
##
## Test of Moderators (coefficient 2):
## QM(df = 1) = 4.1048, p-val = 0.0428
##
## Model Results:
##
##          estimate      se    zval    pval    ci.lb   ci.ub
## intrcpt    0.7586  0.8956  0.8470  0.3970  -0.9967  2.5139
## Coping     2.5868  1.2768  2.0260  0.0428   0.0844  5.0893  *
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

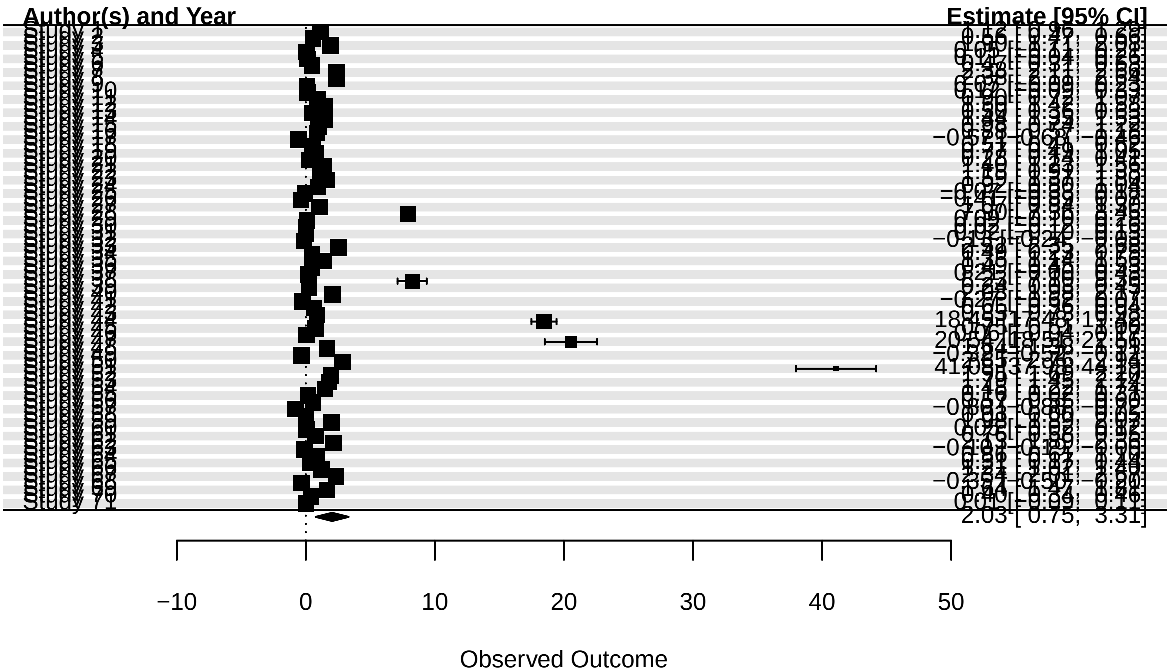
```r
PTGI_religion = rma(g ~ `Sprituality/Religion`, vi = v_g, data = PTGI_g)
PTGI_religion
```

```
##
## Mixed-Effects Model (k = 71; tau^2 estimator: REML)
##
## tau^2 (estimated amount of residual heterogeneity):     30.0370 (SE = 5.1248)
## tau (square root of estimated tau^2 value):             5.4806
## I^2 (residual heterogeneity / unaccounted variability): 99.99%
## H^2 (unaccounted variability / sampling variability):   10093.36
## R^2 (amount of heterogeneity accounted for):            0.38%
##
## Test for Residual Heterogeneity:
## QE(df = 69) = 14393.9986, p-val < .0001
##
## Test of Moderators (coefficient 2):
## QM(df = 1) = 1.4099, p-val = 0.2351
##
## Model Results:
##
##                         estimate      se    zval    pval    ci.lb   ci.ub
## intrcpt                   1.4640  0.8086  1.8105  0.0702  -0.1209  3.0489  .
## `Sprituality/Religion`    1.6193  1.3638  1.1874  0.2351  -1.0536  4.2922
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
### coping and anxiety are significant with coping clearly significant.



#################################################################
## Tables and Figures
#################################################################
## forest plot
ptsd_sample = PTGI_g %>% filter(`PTSD` == 1) %>% dplyr::select(Source, `sample size`)
forest(main_analysis_model_PTGI,
       header="Author(s) and Year", mlab="", shade=TRUE,
       cex=0.75)
```




```r
## create tables for main analysis (table 1 in the manuscript)
PTGI_main_analysis_table = PTGI_g %>% dplyr::select(Source, `sample size`,
                                           `effect size`, sd) %>%
  mutate(`effect size` = round(`effect size`,2)) %>%
  mutate(sd = round(sd,2))
## this is table 1
PTGI_main_analysis_table %>%
  kbl() %>%
  kable_classic(full_width = F, html_font = "Cambria")
```

```r
## create tables for subgroup analysis (table 3 in the manuscript)
# Source    Year    Sample size Male,%  Age (mean)  End Point   Follow up, y    Determinant
PTGI_subgroup = PTGI %>% dplyr::select("Source", "sample size","PTSD", "Anxiety",
                                       "Depression", "Social Support",
                                       "Coping","Sprituality/Religion")
## this is table 3
PTGI_subgroup  %>%
  kbl() %>%
  kable_classic(full_width = F, html_font = "Cambria")
```

Source	sample size	effect size	sd
Arnout and Al-Sufyani (2021)	365	65.19	17.94
Chasson et al. (2022)	916	55.78	19.10
Chen & Tang (2021)	422	64.80	10.44
Gul (2023)	300	45.57	11.70
Kalaitzaki et al. (2022)	352	47.73	24.63
Lau et al. (2021)	327	53.13	17.22
Lyu et al. (2021)	251	78.40	14.00
Mo (2022)	266	96.26	21.57
Northfield & Johnston (2021)	296	47.00	28.20
Willey et al.(2022)	176	47.95	24.48
Yıldız (2021)	292	63.49	20.64
Zhang et al. (2021)	1790	67.17	14.79
Zhou et al.(2020)	442	58.34	26.76
Yao et al. (2023)	1512	71.75	18.53
Das et al. (2023)	166	64.81	20.27
Wang et. al (2023)	100	63.36	20.91
Castiglioni et. al (2023)	733	31.82	23.10
Morales et al (2023)	785	51.44	12.50
Lan et al (2023)	115	62.83	23.19
Kalaitzaki et al. (2023)	429	50.52	20.00
Bai et al. (2023)	407	75.47	21.80
Akdag et al. (2023)	184	70.91	22.54
Atay et al. (2023)	263	69.95	15.73
Bai et al. (2024)	692	62.09	18.56
Cardinali et al. (2023)	118	43.05	26.59
Carola et al. (2022)	35	34.51	25.46
Dahan et al. (2022)	183	63.21	17.00
Kalaitzaki et al. (2024)	429	62.24	2.18
Kapur et al. (2022)	213	47.40	27.00
Levinsky et al. (2024)	369	45.55	27.28
Liu G. et al (2024)	575	45.45	25.45
Liu S. et al (2024)	669	37.09	58.86
Nie et al. (2021)	760	83.58	15.33
Nowicki et al. (2024)	120	57.54	25.41
Özönder et al. (2023)	253	58.09	9.69
Petrocchi et al. (2023)	4934	68.25	47.67
Pfeiffer et al. (2023)	163	50.40	25.20
Read et al. (2022)	109	67.49	2.73
Sarialioglu et al. (2022)	175	50.98	25.30
Wu (2024)	1711	88.20	20.79
Yilmaz-Karaman et al. (2023)	66	37.86	26.28
Yim et al. (2022)	100	57.49	19.23
Zhang et al. (2023)	589	64.46	22.79
Paeizi et al. (2024)	700	54.60	0.52
Foster et al. (2024)	144	61.03	21.28
Kalaitzaki et al. (2021)	673	46.60	24.61
Liu et al. (2021)	200	66.78	1.06
Kowalski et al. (2021)	179	47.04	1.24
Fino et al. (2023)	202	37.10	24.70
Jiang et al. (2022)	2750	97.09	18.27
Song et al. (2024)	338	76.65	0.77
Sun et al. (2022)	233	76.18	16.00
Peng et al. (2021)	116	65.65	11.50
Cui et al.	179	70.53	17.26
Adjorlolo et al. (2022)	381	46.74	10.61
Chen et al.(2020)	12596	58.80	24.15
Lewis et al. (2022)	1424	26.54	23.12
[illegible]	[illegible]	[illegible]	[illegible]

Source	sample size	PTSD	Anxiety	Depression	Social Support	Coping	Sprituality/
Arnout and Al-Sufyani (2021)	365	1	1	1	0	0	
Chasson et al. (2022)	916	0	1	0	0	0	
Chen & Tang (2021)	422	1	0	0	0	0	
Gul (2023)	300	0	0	0	1	0	
Kalaitzaki et al. (2022)	352	0	1	1	1	1	
Lau et al. (2021)	327	1	0	0	0	0	
Lyu et al. (2021)	251	0	0	0	0	0	
Mo (2022)	266	1	0	0	1	0	
Northfield & Johnston (2021)	296	0	0	0	1	0	
Willey et al.(2022)	176	0	1	1	0	1	
Yıldız (2021)	292	0	0	0	0	0	
Zhang et al. (2021)	1790	1	0	0	1	1	
Zhou et al.(2020)	442	0	1	1	1	1	
Yao et al. (2023)	1512	0	0	0	0	0	
Das et al. (2023)	166	1	0	0	0	0	
Wang et. al (2023)	100	1	0	0	0	0	
Castiglioni et. al (2023)	733	0	1	1	0	0	
Morales et al (2023)	785	0	1	1	1	0	
Lan et al (2023)	115	1	0	0	0	0	
Kalaitzaki et al. (2023)	429	0	0	0	0	1	
Bai et al. (2023)	407	0	0	0	0	0	
Akdag et al. (2023)	184	1	0	0	1	0	
Atay et al. (2023)	263	0	0	0	0	1	
Bai et al. (2024)	692	0	0	0	0	1	
Cardinali et al. (2023)	118	0	0	0	0	1	
Carola et al. (2022)	35	0	1	0	0	0	
Dahan et al. (2022)	183	0	1	0	0	1	
Kalaitzaki et al. (2024)	429	0	0	0	0	1	
Kapur et al. (2022)	213	0	0	0	0	1	
Levinsky et al. (2024)	369	0	1	1	0	0	
Liu G. et al (2024)	575	0	1	1	0	0	
Liu S. et al (2024)	669	0	1	0	0	1	
Nie et al. (2021)	760	0	0	0	0	1	
Nowicki et al. (2024)	120	0	0	0	0	0	
Özönder et al. (2023)	253	0	0	0	0	1	
Petrocchi et al. (2023)	4934	0	1	0	0	1	
Pfeiffer et al. (2023)	163	0	0	0	0	0	
Read et al. (2022)	109	0	0	0	0	1	
Sarialioglu et al. (2022)	175	0	0	0	0	1	
Wu (2024)	1711	0	0	0	1	1	
Yilmaz-Karaman et al. (2023)	66	0	1	0	0	1	
Yim et al. (2022)	100	1	0	0	1	0	
Zhang et al. (2023)	589	0	1	0	0	1	
Paeizi et al. (2024)	700	0	0	0	0	1	
Foster et al. (2024)	144	0	1	1	0	1	
Kalaitzaki et al. (2021)	673	0	0	0	1	1	
Liu et al. (2021)	200	0	0	0	0	1	
Kowalski et al. (2021)	179	0	0	0	0	1	
Fino et al. (2023)	202	1	0	0	1	1	
Jiang et al. (2022)	2750	1	0	0	0	0	
Song et al. (2024)	338	0	0	0	1	1	
Sun et al. (2022)	233	0	0	0	0	1	
Peng et al. (2021)	116	0	0	0	1	0	
Cui et al.	179	0	0	0	0	1	
Adjorlolo et al. (2022)	381	0	1	1	1	0	
Chen et al.(2020)	12596	1	0	0	0	0	
Lewis et al. (2022)	1424	1	0	0	0	0	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	