Research Transparency in 59 Disciplines of Clinical Medicine: A Meta-Research Study

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1 Aim

We aimed to assess the adherence to five transparent practices (data availability, code availability, protocol registration and conflicts of interest (COI), and funding disclosures) from open-access articles published in medical journals.

2 Results

First, loading the needed packages:

```
pacman::p_load(dplyr,
                ggplot2,
                knitr,
                gtsummary,
                tidyr,
                lubridate,
                forcats,
                DiagrammeR,
                tibble,
                ggrepel,
                ggpubr,
                epiR,
                here,
                lme4,
                nortest,
                stringr,
                expss,
                dvmisc,
                sjPlot,
                eply)
```

And then, loading the datasets:

```
transparency = read.csv("data/medicaltransparency_opendata.csv")
transparency = transparency %>% filter(type %in% c("research-article", "review-article", "system for the system of the system of
```

Now, let's create a dataset without the duplicates:

```
unique_transparency = transparency[!duplicated(transparency$pmid), ]
```

2.1 General characteristics

Number of all papers (open access and non open access), open-access papers and open-access percentage.

First, we delete duplicated ISSNs to capture the true number of all articles (without any duplication):

```
# ISSNs = read.csv("data/journals.csv")
# ISSNs = ISSNs %>% filter(Category != "MULTIDISCIPLINARY SCIENCES - SCIE")
# ISSNs_unique = ISSNs[!duplicated(ISSNs$ISSN), ]
# ISSNs_unique = ISSNs_unique %>% mutate(search.term = paste0("ISSN:", ISSN))
# ISSNsQuery_unique = ISSNs_unique %>%
         group by(Category) %>% summarize(query = paste(search.term,
                                                         collapse = " OR "))
# ISSNsQuery unique = as.data.frame(ISSNsQuery unique)
# hits list unique = data.frame()
# hits_list_unique = sapply(ISSNsQuery_unique$query, function(issn) {
         search_string = paste0(
                 "(",
#
#
                 issn,
                 ") ",
                 'AND (SRC: "MED")
     AND (LANG: "eng" OR LANG: "en" OR LANG: "us")
     AND (FIRST_PDATE: [1990-01-01 TO 2024-03-16])
     AND (PUB_TYPE: "research-article" OR PUB_TYPE: "review-article" OR PUB_TYPE: "systematic-re
#
#
         epmc_hits(query = search_string)
#})
# hits_list_unique = as.data.frame(hits_list_unique)
# rownames(hits_list_unique) = ISSNsQuery$Category
# write.csv(hits_list_unique, "data/hits_list_unique.csv")
hits_list_unique = read.csv("data/hits_list_unique.csv")
```

Now, we do the same but with duplicates to have the exact number of articles for each category:

```
# ISSNs = ISSNs %>% mutate(search.term = paste0("ISSN:", ISSN))
# ISSNsQuery = ISSNs %>%
# group_by(Category) %>% summarize(query = paste(search.term,
```

```
collapse = " OR "))
 # ISSNsQuery = as.data.frame(ISSNsQuery)
 # hits_list = data.frame()
 # hits_list = sapply(ISSNsQuery$query, function(issn) {
                                        search_string = paste0(
 #
                                                                           "(",
 #
 #
                                                                           issn,
                                                                           ") ",
                                                                           'AND (SRC: "MED")
 #
                    AND (LANG: "eng" OR LANG: "en" OR LANG: "us")
 #
                     AND (FIRST_PDATE: [1990-01-01 TO 2024-03-16])
 #
                     AND (PUB_TYPE: "research-article" OR PUB_TYPE: "review-article" OR PUB_TYPE: "systematic-relation or pub_typ
 #
                                     )
                                        epmc_hits(query = search_string)
 #})
 # hits_list = as.data.frame(hits_list)
 # rownames(hits_list) = ISSNsQuery$Category
 # write.csv(hits_list, "data/hits_list.csv")
hits_list = read.csv("data/hits_list.csv")
```

Now, calculating open-access percentage:

hits_all	hits_oa	oa_percentage
3397155	2002955	59

Let's take a look at the number of papers published in each year and overall. To do so, first, we add the real publication year and month to the datasets. The real publication year/month is the year/month the paper was first appear online stored in firstPublicationDate column.

```
month_firstpub = month(
      as.POSIX1t(firstPublicationDate,
               format = "%Y-%m-%d")
    )
    )
unique_transparency = unique_transparency %>%
        mutate(pubYear_modified =
                       ifelse(year_firstpub < 2000, "< 2000",</pre>
                     ifelse((year_firstpub >= 2000) & (year_firstpub < 2005), "2000-2004",
                     ifelse((year_firstpub >= 2005) & (year_firstpub < 2010), "2005-2009",</pre>
                     year_firstpub))))
transparency = transparency %>%
  mutate(year_firstpub = year(
    as.POSIX1t(firstPublicationDate,
               format = "%Y-%m-%d")),
   month_firstpub = month(
     as.POSIX1t(firstPublicationDate,
              format = "%Y-%m-%d")
    )
    )
transparency = transparency %>%
        mutate(pubYear_modified =
                       ifelse(year_firstpub < 2000, "< 2000",</pre>
                     ifelse((year_firstpub >= 2000) & (year_firstpub < 2005), "2000-2004",
                     ifelse((year_firstpub >= 2005) & (year_firstpub < 2010), "2005-2009",
                     year_firstpub))))
```

Now, the number of open access papers per year:

Table printed with `knitr::kable()`, not {gt}. Learn why at https://www.danieldsjoberg.com/gtsummary/articles/rmarkdown.html
To suppress this message, include `message = FALSE` in code chunk header.

Characteristic	N = 2,002,955
pubYear_modified	
< 2000	40,307 (2.0%)
2000-2004	$16,711 \ (0.8\%)$
2005-2009	$68,021 \ (3.4\%)$
2010	$30,773 \ (1.5\%)$
2011	$37,739 \ (1.9\%)$
2012	$47,077 \ (2.4\%)$
2013	$62,166 \ (3.1\%)$
2014	$75,961 \ (3.8\%)$
2015	84,894 (4.2%)
2016	$91,473 \ (4.6\%)$
2017	105,762~(5.3%)
2018	126,410~(6.3%)
2019	$149,891 \ (7.5\%)$
2020	213,102 (10.6%)
2021	$276,896 \ (13.8\%)$
2022	$303,395 \ (15.1\%)$
2023	238,246 (11.9%)
2024	34,131 (1.7%)

Paper types frequency:

Table printed with `knitr::kable()`, not {gt}. Learn why at https://www.danieldsjoberg.com/gtsummary/articles/rmarkdown.html
To suppress this message, include `message = FALSE` in code chunk header.

Characteristic	N = 2,002,955
type	
research-article	$1,741,152 \ (86.9\%)$
review-article	$258,470\ (12.9\%)$
systematic-review	3,333~(0.2%)

Now, comparing journals:

```
set.seed(1280)
unique_transparency %>%
        select(journalTitle,
               is_coi_pred,
               is_fund_pred,
               is_register_pred,
               is_open_data,
               is_open_code) %>%
        mutate(journalTitle = fct_lump(journalTitle, n = 5)) %>%
        tbl_summary(by = journalTitle,
                    percent = "column",
                    label = c(is_coi_pred ~ "COI disclosure",
                              is_fund_pred ~ "Funding disclosure",
                              is_register_pred ~ "Protocol registration",
                              is_open_data ~ "Data sharing",
                              is_open_code ~ "Code sharing"),
                    digits = list(all_categorical() ~ c(0, 1))) %>%
        add_p(test.args = all_tests("fisher.test") ~ list(simulate.p.value=TRUE)) %>%
        as_flex_table()
```

Characteristic	Front Immunol, $N = 32,224^1$	Int J Environ Res Public Health, $N=59{,}448^1$
COI disclosure	32,174 (99.8%)	58,530 (98.5%)
Funding disclosure	$29,358 \ (91.1\%)$	57,781 (97.2%)
Protocol registration	606 (1.9%)	2,581 (4.3%)
Data sharing	3,204 (9.9%)	1,881 (3.2%)
Code sharing	400 (1.2%)	320~(0.5%)

 $^{^{1}}$ n (%)

Publishers:

²Pearson's Chi-squared test

190773 observations missing `scimago_publisher` have been removed. To include these observat

Characteristic	Elsevier, $N = 86,540^1$	Frontiers Media S.A., $N = 167,114^1$	John Wiley &
COI disclosure	76,044 (87.9%)	166,674 (99.7%)	101
Funding disclosure	$73,953 \ (85.5\%)$	142,884 (85.5%)	95
Protocol registration	$9,143\ (10.6\%)$	5,194 (3.1%)	8
Data sharing	$6,326 \ (7.3\%)$	11,831 (7.1%)	11
Code sharing	$1,374\ (1.6\%)$	$3,474 \ (2.1\%)$	1

 $^{^{1}}$ n (%)

What about article types?

²Pearson's Chi-squared test

Characteristic	research-article, $N = 1,741,152^1$	review-article, $N = 258,470^1$	systematic
COI disclosure	$1,538,157 \ (88.3\%)$	237,981 (92.1%)	3,
Funding disclosure	$1,443,743 \ (82.9\%)$	$199,472 \ (77.2\%)$	3,
Protocol registration	122,617 (7.0%)	15,183 (5.9%)	1,
Data sharing	$156,064 \ (9.0\%)$	$4,014\ (1.6\%)$	Ę
Code sharing	29,068 (1.7%)	707 (0.3%)	

 $^{^{1}}$ n (%)

2.2 Category-specific characteristics

Top categories in terms of number of papers

Top 3 highest:

```
transparency %>% group_by(category) %>% summarise(n = n(), p = round(n/nrow(transparency)*10
```

²Pearson's Chi-squared test

Top 3 lowest:

```
transparency %>% group_by(category) %>% summarise(n = n(), p = round(n/nrow(transparency)*10
# A tibble: 3 x 3
  category
                                                   p
  <chr>>
                                         <int> <dbl>
1 Medicine, Legal
                                          1231 0.05
2 Audiology & Speech-language Pathology 1571 0.06
3 Medical Ethics
                                          2959 0.12
Fields with the highest number of trials and reviews
Trials:
transparency %>% filter(is_trial == T) %>% group_by(category) %>% summarise(n = n(), p=round
# A tibble: 3 x 3
  category
                                         n
                                               p
                                     <int> <dbl>
1 Medicine, Research & Experimental 12424 13.6
2 Medicine, General & Internal
                                     11344 12.5
3 Oncology
                                      9214 10.1
Reviews:
transparency %>% filter(is_review == T) %>% group_by(category) %>% summarise(n = n(), p=round
# A tibble: 3 x 3
  category
                                    n
                                          p
  <chr>>
                                <int> <dbl>
1 Oncology
                                31676 12.1
```

2.2.1 Appendix 2

Column 1: Number of journals in each category

2 Medicine, General & Internal 28982 11.1

3 Pharmacology & Pharmacy

26493 10.1

```
ISSNs = read.csv("data/journals.csv")
ISSNs = ISSNs %>% filter(Category != "MULTIDISCIPLINARY SCIENCES - SCIE")
appendix2 = data.frame()
appendix2 = ISSNs %>% group_by(Category) %>% summarise(all_journals = n())
```

Column 2: Available journals in each category based on ISSN

Column 3: Percentage based on column 2

```
appendix2$availability_percentage_issn = appendix2$available_journals_issn/appendix2$all_journals_
```

Column 4: Available journals in each category based on journal title

```
appendix2$available_journals_name = (transparency %>% group_by(category) %>% summarise(available)
```

Column 5: Percentage based on column 4

```
appendix2$availability_percentage_name = round(appendix2$available_journals_name/appendix2$a
```

Column 6: All articles

```
appendix2$all_articles_20240316 = hits_list$hits_list
```

Column 7: Open-access articles

```
appendix2$oa_articles_20240316 = table(transparency$category)
```

Column 8: Open-access percentage

```
appendix2$percentage_oa = round(appendix2$oa_articles_20240316/appendix2$all_articles_202403
```

Now, we can save it:

```
# write.csv(appendix2, "appendix/Appendix2.csv", row.names = F)
```

Open-access availability based on name:

```
c(mean(appendix2$availability_percentage_name), sd(appendix2$availability_percentage_name))
```

```
[1] 89.178305 8.596136
```

2 TROPICAL MEDICINE - SCIE

Top 3 categories with the most open-access availability:

Top 3 categories with the least open-access availability:

3 MEDICINE, RESEARCH & EXPERIMENTAL - SCIE

```
appendix2 %>% select(Category, oa_articles_20240316, percentage_oa) %>% arrange(percentage_oa)
```

32342

176858

84.58

75.84

And categories:

Characteristic	Medicine, General & Internal, $N=199{,}331^1$	Medicine, Research & Experin
COI disclosure	180,703 (90.7%)	138,666 (78.4%
Funding disclosure	$159,090 \ (79.8\%)$	140,803 (79.6%
Protocol registration	25,679 (12.9%)	12,689 (7.2%)
Data sharing	8,795 (4.4%)	13,920 (7.9%)
Code sharing	$1,416 \ (0.7\%)$	$1,516 \ (0.9\%)$

 $^{^{1}}$ n (%)

2.3 Overall adherence to transparency practices

2.3.1 All articles

Number and percentage:

²Pearson's Chi-squared test

```
),

Code = data.frame(number = length(unique_transparency$is_open_code[unique_transparency
percentage = round(length(unique_transparency$is_open_code[unique_transparency$is_
)
))
```

	number	percentage
COI	1779458	88.8
Fund	1646303	82.2
Register	139764	7.0
Data	160397	8.0
Code	29786	1.5

And CIs:

```
kable(rbind(COI=round(epi.prev(pos = length(unique_transparency$is_coi_pred[unique_transparency
                                tested = nrow(unique_transparency),
                                se = 0.992,
                                sp = 0.995) p,
                      1),
                      Funding=round(epi.prev(pos = length(unique_transparency$is_fund_pred[unique_transparency
                                tested = nrow(unique_transparency),
                                se = 0.997,
                                sp = 0.981) p,
                      1),
                      Protocol=round(epi.prev(pos = length(unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique_transparency$is_register_pred[unique
                                tested = nrow(unique_transparency),
                                se = 0.955,
                                sp = 0.997) p,
                      1),
                      Data=round(epi.prev(pos = length(unique_transparency$is_open_data[unique_transparency$
                                tested = nrow(unique_transparency),
                                se = 0.758,
                                sp = 0.986) p,
                      1),
                      Code=round(epi.prev(pos = length(unique_transparency$is_open_code[unique_transparency$
                                tested = nrow(unique_transparency),
                                se = 0.587,
                                sp = 0.997) p,
                      1)))
```

	est	lower	upper
COI	88.8	88.8	88.9
Funding	82.2	82.1	82.2
Protocol	7.0	6.9	7.0
Data	8.0	8.0	8.0
Code	1.5	1.5	1.5

2.4 Adherence by number of practices

```
unique_transparency = unique_transparency %>% mutate(sumOfIndicators = rowSums(unique_transparency)
```

Number of papers with each number of TRUE indicators:

```
c(five_ind = nrow(filter(unique_transparency, sumOfIndicators == 5)),
  four_ind = nrow(filter(unique_transparency, sumOfIndicators == 4)),
  three_ind = nrow(filter(unique_transparency, sumOfIndicators == 3)),
  two_ind = nrow(filter(unique_transparency, sumOfIndicators == 2)),
  one_ind = nrow(filter(unique_transparency, sumOfIndicators == 1)),
  zero_ind = nrow(filter(unique_transparency, sumOfIndicators == 0)))
```

```
five_ind four_ind three_ind two_ind one_ind zero_ind 419 22512 247187 1298604 324796 109437
```

Percentage of papers with each number of TRUE indicators:

```
c(five_ind = round(nrow(filter(unique_transparency, sumOfIndicators == 5))/nrow(unique_transparency)
four_ind = round(nrow(filter(unique_transparency, sumOfIndicators == 4))/nrow(unique_transparency)
three_ind = round(nrow(filter(unique_transparency, sumOfIndicators == 3))/nrow(unique_transparency)
two_ind = round(nrow(filter(unique_transparency, sumOfIndicators == 2))/nrow(unique_transparency)
one_ind = round(nrow(filter(unique_transparency, sumOfIndicators == 1))/nrow(unique_transparency)
zero_ind = round(nrow(filter(unique_transparency, sumOfIndicators == 0))/nrow(unique_transparency)
```

```
five_ind four_ind three_ind two_ind one_ind zero_ind 0.0209 1.1000 12.3000 64.8000 16.2000 5.5000
```

2.4.1 Reviews

Number and percentage:

```
reviews = unique_transparency %>% filter(is_review == T)
kable(rbind(
                    COI = data.frame(number = length(reviews$is_coi_pred[reviews$is_coi_pred == TRUE]),
                           percentage = round(length(reviews$is_coi_pred[reviews$is_coi_pred == TRUE])/nrow()
                            ),
                      Fund = data.frame(number = length(reviews$is_fund_pred[reviews$is_fund_pred == TRUE]
                            percentage = round(length(reviews$is_fund_pred[reviews$is_fund_pred == TRUE])/nro
                            ),
                    Register = data.frame(number = length(reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews$is_register_pred[reviews]]]
                            percentage = round(length(reviews$is_register_pred[reviews$is_register_pred == TR)
                            ),
                    Data = data.frame(number = length(reviews$is_open_data[reviews$is_open_data == TRUE]
                            percentage = round(length(reviews$is_open_data[reviews$is_open_data == TRUE])/nro
                            ),
                    Code = data.frame(number = length(reviews$is_open_code[reviews$is_open_code == TRUE]
                            percentage = round(length(reviews$is_open_code[reviews$is_open_code == TRUE])/nro
                            )
                            ))
```

	number	percentage
COI	241301	92.2
Fund	202560	77.4
Register	17147	6.5
Data	4333	1.7
Code	718	0.3

And CIs:

```
sp = 0.981)$ap,
1),
Protocol=round(epi.prev(pos = length(reviews$is_register_pred[reviews$is_register_pred
  tested = nrow(reviews),
   se = 0.955,
   sp = 0.997) p,
1),
Data=round(epi.prev(pos = length(reviews$is_open_data[reviews$is_open_data == TRUE]),
   tested = nrow(reviews),
   se = 0.758,
   sp = 0.986) p,
1),
Code=round(epi.prev(pos = length(reviews$is_open_code[reviews$is_open_code == TRUE]),
   tested = nrow(reviews),
   se = 0.587,
   sp = 0.997) p,
1)))
```

Warning in epi.prev(pos = length(reviews\$is_open_code[reviews\$is_open_code == : Apparent prevalence is less than (1 - Sp). Rogan Gladen estimate of true prevalence invalid.

	est	lower	upper
COI	92.2	92.1	92.3
Funding	77.4	77.2	77.5
Protocol	6.5	6.5	6.6
Data	1.7	1.6	1.7
Code	0.3	0.3	0.3

Percentage of papers with each number of TRUE indicators:

```
c(five_ind = round(nrow(filter(reviews, sumOfIndicators == 5))/nrow(reviews)*100, 4),
 four_ind = round(nrow(filter(reviews, sumOfIndicators == 4))/nrow(reviews)*100, 1),
 three_ind = round(nrow(filter(reviews, sumOfIndicators == 3))/nrow(reviews)*100, 1),
 two_ind = round(nrow(filter(reviews, sumOfIndicators == 2))/nrow(reviews)*100, 1),
  one_ind = round(nrow(filter(reviews, sumOfIndicators == 1))/nrow(reviews)*100, 1),
 zero_ind = round(nrow(filter(reviews, sumOfIndicators == 0))/nrow(reviews)*100, 1))
five_ind four_ind three_ind
                                {\tt two\_ind}
                                          one_ind
                                                   zero_ind
  0.0118
             0.4000
                       6.7000
                                67.8000
                                          20.5000
                                                     4.5000
```

2.4.2 Trials

Number and percentage:

```
trials = unique_transparency %>% filter(is_trial == T)
kable(rbind(
        COI = data.frame(number = length(trials$is_coi_pred[trials$is_coi_pred == TRUE]),
           percentage = round(length(trials$is_coi_pred[trials$is_coi_pred == TRUE])/nrow(tr
           ),
         Fund = data.frame(number = length(trials$is_fund_pred[trials$is_fund_pred == TRUE])
           percentage = round(length(trials$is_fund_pred[trials$is_fund_pred == TRUE])/nrow(
           ),
        Register = data.frame(number = length(trials$is_register_pred[trials$is_register_pred
           percentage = round(length(trials$is_register_pred[trials$is_register_pred == TRUE]
           ),
        Data = data.frame(number = length(trials$is_open_data[trials$is_open_data == TRUE]),
           percentage = round(length(trials$is_open_data[trials$is_open_data == TRUE])/nrow(
           ),
        Code = data.frame(number = length(trials$is_open_code[trials$is_open_code == TRUE]),
           percentage = round(length(trials$is_open_code[trials$is_open_code == TRUE])/nrow(
           )
           ))
```

	number	percentage
COI	84689	93.1
Fund	80102	88.0
Register	54282	59.6
Data	4118	4.5
Code	335	0.4

And CIs:

```
sp = 0.981)$ap,
1),
Protocol=round(epi.prev(pos = length(trials$is_register_pred[trials$is_register_pred ==
   tested = nrow(trials),
   se = 0.955,
   sp = 0.997) p,
1),
Data=round(epi.prev(pos = length(trials$is_open_data[trials$is_open_data == TRUE]),
   tested = nrow(trials),
   se = 0.758,
   sp = 0.986) p,
1),
Code=round(epi.prev(pos = length(trials$is_open_code[trials$is_open_code == TRUE]),
   tested = nrow(trials),
   se = 0.587,
   sp = 0.997) p,
1)))
```

	est	lower	upper
COI	93.1	92.9	93.2
Funding	88.0	87.8	88.2
Protocol	59.6	59.3	60.0
Data	4.5	4.4	4.7
Code	0.4	0.3	0.4

Percentage of papers with each number of TRUE indicators:

```
c(five_ind = round(nrow(filter(trials, sumOfIndicators == 5))/nrow(trials)*100, 4),
  four_ind = round(nrow(filter(trials, sumOfIndicators == 4))/nrow(trials)*100, 1),
  three_ind = round(nrow(filter(trials, sumOfIndicators == 3))/nrow(trials)*100, 1),
  two_ind = round(nrow(filter(trials, sumOfIndicators == 2))/nrow(trials)*100, 1),
  one_ind = round(nrow(filter(trials, sumOfIndicators == 1))/nrow(trials)*100, 1),
  zero_ind = round(nrow(filter(trials, sumOfIndicators == 0))/nrow(trials)*100, 1))
five_ind four_ind three_ind two_ind one_ind zero_ind
  0.0934  3.0000  53.3000  32.4000  8.6000  2.7000
```

2.5 Transparency practices by fields over time

2.5.1 Overall trend

First, we calculate the proportion of adherence to each domain overall and yearly adherence to each domain:

```
# Overall
proportions = unique_transparency %>%
        summarise("COI disclosure" = sum(is_coi_pred == TRUE),
                  "Funding disclosure" = sum(is_fund_pred == TRUE),
                  "Protocol registration" = sum(is_register_pred == TRUE),
                  "Data sharing" = sum(is_open_data == TRUE),
                  "Code sharing" = sum(is open code == TRUE)) %>%
        t() %>%
        as.data.frame() %>%
        rownames_to_column(var = "indicator") %>%
        mutate(percentage = round(V1/nrow(unique_transparency)*100, 1))
indicator_by_year =
        unique_transparency %>%
        select(pubYear_modified,
               is_coi_pred,
               is_fund_pred,
               is_register_pred,
               is_open_data,
               is_open_code) %>%
        gather("indicator", "value", -pubYear_modified) %>%
        count(pubYear_modified, indicator, value) %>%
        mutate(indicator = dplyr::recode(indicator,
                                  is_coi_pred = "COI disclosure",
                                  is_fund_pred = "Funding disclosure",
                                  is_register_pred = "Protocol registration",
                                  is_open_data = "Data sharing",
                                  is_open_code = "Code sharing")) %>%
        complete(indicator, value, pubYear_modified, fill = list(n = 0)) %>%
        group_by(pubYear_modified, indicator) %>%
        mutate(p = n / sum(n)) \%>\%
        filter(value) %>%
        ungroup()
```

```
# For reviews
proportions_reviews = unique_transparency %>%
        filter(is review == T) %>%
        summarise("COI disclosure" = sum(is_coi_pred == TRUE),
                  "Funding disclosure" = sum(is fund pred == TRUE),
                  "Protocol registration" = sum(is_register_pred == TRUE),
                  "Data sharing" = sum(is open data == TRUE),
                  "Code sharing" = sum(is_open_code == TRUE)) %>%
        t() %>%
        as.data.frame() %>%
        rownames_to_column(var = "indicator") %>%
        mutate(percentage = round(V1/nrow(filter(unique_transparency, is_review == T))*100,
indicator_by_year_reviews =
        unique_transparency %>%
        filter(is_review == T) %>%
        select(pubYear_modified,
               is_coi_pred,
               is_fund_pred,
               is_register_pred,
               is_open_data,
               is_open_code) %>%
        gather("indicator", "value", -pubYear_modified) %>%
        count(pubYear_modified, indicator, value) %>%
        mutate(indicator = dplyr::recode(indicator,
                                  is_coi_pred = "COI disclosure",
                                  is_fund_pred = "Funding disclosure",
                                  is_register_pred = "Protocol registration",
                                  is_open_data = "Data sharing",
                                  is_open_code = "Code sharing")) %>%
        complete(indicator, value, pubYear_modified, fill = list(n = 0)) %>%
        group_by(pubYear_modified, indicator) %>%
        mutate(p = n / sum(n)) \%
        filter(value) %>%
        ungroup()
# For trials
proportions_trials = unique_transparency %>%
        filter(is_trial == T) %>%
        summarise("COI disclosure" = sum(is_coi_pred == TRUE),
```

```
"Funding disclosure" = sum(is_fund_pred == TRUE),
                  "Protocol registration" = sum(is_register_pred == TRUE),
                  "Data sharing" = sum(is_open_data == TRUE),
                  "Code sharing" = sum(is_open_code == TRUE)) %>%
        t() %>%
        as.data.frame() %>%
        rownames_to_column(var = "indicator") %>%
        mutate(percentage = round(V1/nrow(filter(unique_transparency, is_trial == T))*100, 1
indicator_by_year_trials =
        unique_transparency %>%
        filter(is_trial == T) %>%
        select(pubYear_modified,
               is_coi_pred,
               is_fund_pred,
               is_register_pred,
               is_open_data,
               is_open_code) %>%
        gather("indicator", "value", -pubYear_modified) %>%
        count(pubYear_modified, indicator, value) %>%
        mutate(indicator = dplyr::recode(indicator,
                                  is_coi_pred = "COI disclosure",
                                  is_fund_pred = "Funding disclosure",
                                  is_register_pred = "Protocol registration",
                                  is_open_data = "Data sharing",
                                  is_open_code = "Code sharing")) %>%
        complete(indicator, value, pubYear_modified, fill = list(n = 0)) %>%
        group_by(pubYear_modified, indicator) %>%
        mutate(p = n / sum(n)) \%>\%
        filter(value) %>%
        ungroup()
```

Now, we create plots:

```
### Figure 1A - left
p1 = proportions %>%
    ggplot() +
    aes(
        x = reorder(indicator, V1),
        y = V1,
        fill = indicator
```

```
) +
  geom_col() +
  geom_text(aes(label = percentage), hjust = -0.1, size = 4) +
  coord_flip() +
  labs(title = "A - All articles",
       x = NULL
      y = NULL) +
  theme minimal() +
  theme(legend.position = "none",
        panel.grid.major.y = element_blank(),
        axis.text = element_text(size = 10),
        plot.title = element_text(size=14, face="bold")) +
  scale_fill_manual(values = c("red", viridis::viridis(6)))
### Figure 1A - right
data_ends = indicator_by_year %>%
        filter(pubYear_modified == 2024)
plasma_pal \leftarrow c("blue", viridis::plasma(n = 5))
p2 = indicator_by_year %>%
  ggplot() +
  aes(
   x = pubYear_modified,
   y = p,
    group = indicator,
   color = indicator
  ) +
  geom_line() +
  labs(title = NULL,
       y = NULL,
       x = NULL) +
   geom_text_repel(
   aes(label = indicator),
    data = data_ends,
   nudge_x = 2,
    size = 3
  ) +
  scale_y_continuous(limits = c(0, 1), labels = scales::percent) +
  theme_minimal() +
  theme(legend.position = "none") +
```

Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y,:
conversion failure on '2000-2004' in 'mbcsToSbcs': dot substituted for <e2>
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y,:
conversion failure on '2000-2004' in 'mbcsToSbcs': dot substituted for <80>
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y,:
conversion failure on '2000-2004' in 'mbcsToSbcs': dot substituted for <93>
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y,:
conversion failure on '2005-2009' in 'mbcsToSbcs': dot substituted for <e2>
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y,:
conversion failure on '2005-2009' in 'mbcsToSbcs': dot substituted for <80>
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y,:
conversion failure on '2005-2009' in 'mbcsToSbcs': dot substituted for <93>

```
### Figure 1B - left
p1_reviews = proportions_reviews %>%
    ggplot() +
    aes(
        x = reorder(indicator, V1),
        y = V1,
        fill = indicator
) +
    geom_col() +
    geom_text(aes(label = percentage), hjust = -0.1, size = 4) +
    coord_flip() +
    labs(title = "B - Reviews",
```

```
x = NULL,
       y = NULL) +
  theme_minimal() +
  theme(legend.position = "none",
        panel.grid.major.y = element_blank(),
        axis.text = element_text(size = 10),
        plot.title = element_text(size=14, face="bold")) +
  scale_fill_manual(values = c("red", viridis::viridis(6)))
### Figure 1B - right
data_ends_reviews = indicator_by_year_reviews %>%
        filter(pubYear_modified == 2024)
p2_reviews = indicator_by_year_reviews %>%
  ggplot() +
  aes(
   x = pubYear_modified,
   y = p,
    group = indicator,
   color = indicator
  ) +
  geom_line() +
  labs(title = NULL,
       y = "Proportion of articles",
       x = NULL) +
   geom text repel(
   aes(label = indicator),
    data = data_ends_reviews,
   nudge_x = 2,
    size = 3
  scale_y_continuous(limits = c(0, 1), labels = scales::percent) +
  theme_minimal() +
  theme(legend.position = "none") +
  scale_color_manual(values = c("red", viridis::viridis(6)))+
         theme(axis.text.x = element_text(angle = 45),
        axis.text = element_text(size = 10))
### Fig 1B
figure1B = ggarrange(p1_reviews, p2_reviews,
```

```
ncol = 2, nrow = 1,
align = "hv", common.legend = F)
```

Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y,:
conversion failure on '2000-2004' in 'mbcsToSbcs': dot substituted for <e2>
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y,:
conversion failure on '2000-2004' in 'mbcsToSbcs': dot substituted for <80>
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y,:
conversion failure on '2000-2004' in 'mbcsToSbcs': dot substituted for <93>
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y,:
conversion failure on '2005-2009' in 'mbcsToSbcs': dot substituted for <e2>
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y,:
conversion failure on '2005-2009' in 'mbcsToSbcs': dot substituted for <80>
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y,:
conversion failure on '2005-2009' in 'mbcsToSbcs': dot substituted for <80>

```
### Figure 1C - left
p1_trials = proportions_trials %>%
  ggplot() +
  aes(
   x = reorder(indicator, V1),
   y = V1,
   fill = indicator
  ) +
  geom_col() +
  geom_text(aes(label = percentage), hjust = -0.1, size = 4) +
  coord_flip() +
  labs(title = "C - Trials",
       x = NULL
       y = "Number of articles") +
  theme_minimal() +
  theme(legend.position = "none",
        panel.grid.major.y = element_blank(),
        axis.text = element_text(size = 10),
        plot.title = element_text(size=14, face="bold")) +
```

```
scale_fill_manual(values = c("red", viridis::viridis(6)))
### Figure 1C - right
data_ends_trials = indicator_by_year_trials %>%
        filter(pubYear_modified == 2024)
p2_trials = indicator_by_year_trials %>%
  ggplot() +
  aes(
    x = pubYear_modified,
   y = p,
    group = indicator,
   color = indicator
  ) +
  geom_line() +
  labs(title = NULL,
       y = NULL
       x = "Year") +
   geom_text_repel(
   aes(label = indicator),
    data = data_ends_trials,
   nudge_x = 2,
    size = 3
  ) +
  scale_y_continuous(limits = c(0, 1), labels = scales::percent) +
  theme_minimal() +
  theme(legend.position = "none") +
  scale_color_manual(values = c("red", viridis::viridis(6)))+
         theme(axis.text.x = element_text(angle = 45),
        axis.text = element_text(size = 10))
### Fig 1C
figure1C = ggarrange(p1_trials, p2_trials,
                    ncol = 2, nrow = 1,
                    align = "hv", common.legend = F)
```

```
Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : conversion failure on '2000-2004' in 'mbcsToSbcs': dot substituted for <e2>
```

Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y, :

```
conversion failure on '2000-2004' in 'mbcsToSbcs': dot substituted for <80> Warning in grid.Call(C_textBounds, as.graphicsAnnot(x$label), x$x, x$y, : conversion failure on '2000-2004' in 'mbcsToSbcs': dot substituted for <93>
```

Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2005-2009' in 'mbcsToSbcs': dot substituted for <e2>

Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2005-2009' in 'mbcsToSbcs': dot substituted for <80>

Warning in grid.Call(C_textBounds, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2005-2009' in 'mbcsToSbcs': dot substituted for <93>

figure1

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2000-2004' in 'mbcsToSbcs': dot substituted for <e2>

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2000-2004' in 'mbcsToSbcs': dot substituted for <80>

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2000-2004' in 'mbcsToSbcs': dot substituted for <93>

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2005-2009' in 'mbcsToSbcs': dot substituted for <e2>

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2005-2009' in 'mbcsToSbcs': dot substituted for <80>

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2005-2009' in 'mbcsToSbcs': dot substituted for <93>

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2000-2004' in 'mbcsToSbcs': dot substituted for <e2>

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2000-2004' in 'mbcsToSbcs': dot substituted for <80>

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2000-2004' in 'mbcsToSbcs': dot substituted for <93>

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2005-2009' in 'mbcsToSbcs': dot substituted for <e2>

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2005-2009' in 'mbcsToSbcs': dot substituted for <80>

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2005-2009' in 'mbcsToSbcs': dot substituted for <93>

Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2000-2004' in 'mbcsToSbcs': dot substituted for <e2>

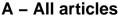
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2000-2004' in 'mbcsToSbcs': dot substituted for <80>

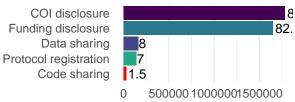
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2000-2004' in 'mbcsToSbcs': dot substituted for <93>

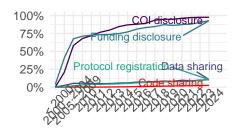
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2005-2009' in 'mbcsToSbcs': dot substituted for <e2>

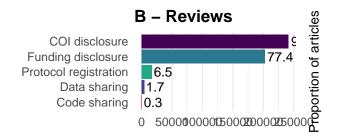
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2005-2009' in 'mbcsToSbcs': dot substituted for <80>

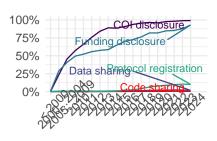
Warning in grid.Call.graphics(C_text, as.graphicsAnnot(x\$label), x\$x, x\$y, : conversion failure on '2005-2009' in 'mbcsToSbcs': dot substituted for <93>



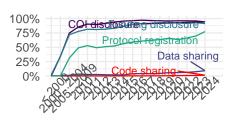








C - Trials COI disclosure Funding disclosure Protocol registration 59.6 Data sharing 4.5 Code sharing 0.4 20000 40000 60000 80000



Number of articles

Year

Now, testing the correlation between year and each transparency indicator:

```
indicator_by_year_all =
        unique_transparency %>%
        select(year_firstpub,
               is_coi_pred,
               is_fund_pred,
               is_register_pred,
               is_open_data,
               is_open_code) %>%
        gather("indicator", "value", -year_firstpub) %>%
        count(year_firstpub, indicator, value) %>%
        mutate(indicator = dplyr::recode(indicator,
                                  is_coi_pred = "COI disclosure",
```

88

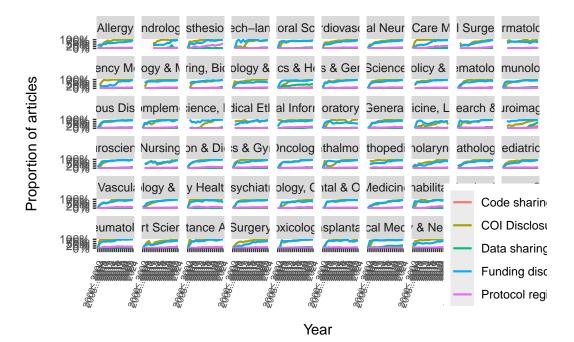
```
is_fund_pred = "Funding disclosure",
                                  is_register_pred = "Protocol registration",
                                  is_open_data = "Data sharing",
                                  is_open_code = "Code sharing")) %>%
        complete(indicator, value, year_firstpub, fill = list(n = 0)) %>%
        group_by(year_firstpub, indicator) %>%
        mutate(p = n / sum(n)) \%>\%
        filter(value) %>%
        ungroup()
cor.test(filter(indicator_by_year_all, indicator == "COI disclosure")$year_firstpub, filter(
    Pearson's product-moment correlation
data: filter(indicator_by_year_all, indicator == "COI disclosure") $ year_firstpub and filter
t = 9.7513, df = 121, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
0.5510357 0.7520713
sample estimates:
     cor
0.663358
cor.test(filter(indicator_by_year_all, indicator == "Funding disclosure")$year_firstpub, fil
    Pearson's product-moment correlation
data: filter(indicator_by_year_all, indicator == "Funding disclosure")$year_firstpub and fil
t = 11.306, df = 121, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
0.6181589 0.7931467
sample estimates:
      cor
0.7167549
cor.test(filter(indicator_by_year_all, indicator == "Protocol registration")$year_firstpub, :
```

Pearson's product-moment correlation

```
data: filter(indicator_by_year_all, indicator == "Protocol registration")$year_firstpub and
 t = 7.9115, df = 121, p-value = 1.355e-12
 alternative hypothesis: true correlation is not equal to 0
 95 percent confidence interval:
    0.4537639 0.6896400
 sample estimates:
                             cor
 0.5838931
cor.test(filter(indicator_by_year_all, indicator == "Data sharing")$year_firstpub, filter(indicator_by_year_all)
                  Pearson's product-moment correlation
 data: filter(indicator_by_year_all, indicator == "Data sharing")$year_firstpub and filter(indicator_by_year_all, indicator == "Data sharing")$year_firstpub and filter(indicator_by_year_all, indicator_sharing")$year_firstpub and filter(indicator_by_year_all, indicator_sharing")$year_firstpub and filter(indicator_by_year_all, indicator_sharing")$year_firstpub and filter(indicator_by_year_all, indicator_sharing")$year_firstpub and filter(indicator_sharing")$year_firstpub and filter(indicator_sharing")$year_firstpu
t = 10.47, df = 121, p-value < 2.2e-16
 alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
   0.5836425 0.7722217
 sample estimates:
                             cor
 0.6894406
cor.test(filter(indicator_by_year_all, indicator == "Code sharing")$year_firstpub, filter(indicator_by_year_all)
                   Pearson's product-moment correlation
data: filter(indicator_by_year_all, indicator == "Code sharing")$year_firstpub and filter(indicator_by_year_all, indicator == "Code sharing")$year_firstpub and filter(indicator_by_year_all, indicator_by_year_all, indicator_by_yea
 t = 6.6146, df = 121, p-value = 1.068e-09
 alternative hypothesis: true correlation is not equal to 0
 95 percent confidence interval:
    0.3722595 0.6344817
 sample estimates:
                        cor
 0.515332
```

2.5.2 Appendix 4: Yearly trends for each field

```
indicator_by_year_all_fields =
        transparency %>%
        select(category,
                pubYear_modified,
               is_coi_pred,
               is_fund_pred,
               is_register_pred,
               is_open_data,
               is_open_code) %>%
        gather("indicator", "value", -pubYear_modified, -category) %>%
        count(category, pubYear_modified, indicator, value) %>%
        mutate(indicator = dplyr::recode(indicator,
                                  is_coi_pred = "COI Disclosure",
                                  is_fund_pred = "Funding disclosure",
                                  is_register_pred = "Protocol registration",
                                  is_open_data = "Data sharing",
                                  is_open_code = "Code sharing")) %>%
        complete(indicator, value, pubYear_modified, category, fill = list(n = 0)) %>%
        group_by(category, pubYear_modified, indicator) %>%
        mutate(p = n / sum(n)) \%
        filter(value) %>%
        ungroup()
transparency_all_fields = indicator_by_year_all_fields %>%
        ggplot() +
        aes(x = pubYear_modified,
            y = p,
            group = indicator,
            color = indicator) +
        geom_line(size = 0.75) +
        facet_wrap(~ category, ncol = 10) +
        scale y continuous(limits = c(0, 1),
                           labels = scales::percent) +
        scale_color_discrete(name = NULL) +
        scale_fill_discrete(breaks = c("COI Disclosure",
                                       "Funding disclosure",
                                       "Protocol registration",
                                       "Data sharing",
                                       "Code sharing")) +
        labs(y = "Proportion of articles \n",
```



#ggsave("appendix/Appendix4.tiff", transparency_all_fields, width = 18, height = 8, units =
#ggsave("appendix/Appendix4.png", transparency_all_fields, width = 18, height = 8, units = ".

2.5.2.1 GLMM: Yearly trend of adherence to transparency practices among different fields

COI disclosure:

```
coi_glmer = glmer(is_coi_pred ~ year_firstpub + (1|category), data = transparency, family = issummary(coi_glmer)
```

Generalized linear mixed model fit by maximum likelihood (Adaptive Gauss-Hermite Quadrature, nAGQ = 10) [glmerMod] Family: binomial (logit)

```
Formula: is_coi_pred ~ year_firstpub + (1 | category)
   Data: transparency
Control: glmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 2e+05))
     AIC
             BIC
                   logLik deviance df.resid
 1227570 1227608 -613782 1227564 2471010
Scaled residuals:
    Min 1Q Median
                                3Q
                                        Max
-25.3150 0.1452 0.1979 0.2973 28.9552
Random effects:
                     Variance Std.Dev.
 Groups Name
 category (Intercept) 0.8
                              0.8944
Number of obs: 2471013, groups: category, 59
Fixed effects:
               Estimate Std. Error z value Pr(>|z|)
(Intercept) -4.818e+02 1.950e-01 -2471 <2e-16 ***
year_firstpub 2.401e-01 1.113e-04 2157 <2e-16 ***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Correlation of Fixed Effects:
           (Intr)
year_frstpb -0.857
optimizer (bobyqa) convergence code: 0 (OK)
Model failed to converge with max|grad| = 0.0359188 (tol = 0.002, component 1)
Model is nearly unidentifiable: very large eigenvalue
 - Rescale variables?
Model is nearly unidentifiable: large eigenvalue ratio
 - Rescale variables?
Funding disclosure:
fund_glmer = glmer(is_fund_pred ~ year_firstpub + (1|category), data = transparency, family =
summary(fund_glmer)
Generalized linear mixed model fit by maximum likelihood (Adaptive
  Gauss-Hermite Quadrature, nAGQ = 10) [glmerMod]
 Family: binomial (logit)
```

```
Formula: is_fund_pred ~ year_firstpub + (1 | category)
   Data: transparency
Control: glmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 2e+05))
                   logLik deviance df.resid
     AIC
              BIC
 2012165 2012204 -1006080 2012159 2471010
Scaled residuals:
  Min 1Q Median
                        3Q
-6.220 0.267 0.346 0.450 46.638
Random effects:
                     Variance Std.Dev.
 Groups
        Name
 category (Intercept) 0.3603
Number of obs: 2471013, groups: category, 59
Fixed effects:
               Estimate Std. Error z value Pr(>|z|)
(Intercept) -2.651e+02 2.815e-01 -941.6 <2e-16 ***
year_firstpub 1.321e-01 1.428e-04 925.1 <2e-16 ***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Correlation of Fixed Effects:
            (Intr)
year_frstpb -0.963
optimizer (bobyqa) convergence code: 0 (OK)
Model failed to converge with max|grad| = 0.0308105 (tol = 0.002, component 1)
Model is nearly unidentifiable: very large eigenvalue
 - Rescale variables?
Model is nearly unidentifiable: large eigenvalue ratio
 - Rescale variables?
Protocol registration:
register_glmer = glmer(is_register_pred ~ year_firstpub + (1|category), data = transparency,
summary(register_glmer)
Generalized linear mixed model fit by maximum likelihood (Adaptive
  Gauss-Hermite Quadrature, nAGQ = 10) [glmerMod]
```

Family: binomial (logit)

```
Formula: is_register_pred ~ year_firstpub + (1 | category)
   Data: transparency
Control: glmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 2e+05))
     AIC
              BIC logLik deviance df.resid
 1173022 1173060 -586508 1173016 2471010
Scaled residuals:
    Min
             1Q Median
                           3Q
-0.8765 -0.3208 -0.2424 -0.1753 18.4747
Random effects:
 Groups
        Name
                     Variance Std.Dev.
 category (Intercept) 0.7428
Number of obs: 2471013, groups: category, 59
Fixed effects:
                Estimate Std. Error z value Pr(>|z|)
(Intercept) -1.717e+02 1.917e-01 -895.9 <2e-16 ***
year_firstpub 8.370e-02 1.095e-04 764.6 <2e-16 ***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Correlation of Fixed Effects:
            (Intr)
year_frstpb -0.862
optimizer (bobyqa) convergence code: 0 (OK)
Model failed to converge with max|grad| = 0.00453864 (tol = 0.002, component 1)
Model is nearly unidentifiable: very large eigenvalue
 - Rescale variables?
Model is nearly unidentifiable: large eigenvalue ratio
 - Rescale variables?
Data sharing:
data_glmer = glmer(is_open_data ~ year_firstpub + (1|category), data = transparency, family =
summary(data_glmer)
Generalized linear mixed model fit by maximum likelihood (Adaptive
  Gauss-Hermite Quadrature, nAGQ = 10) [glmerMod]
 Family: binomial (logit)
```

```
Formula: is_open_data ~ year_firstpub + (1 | category)
   Data: transparency
Control: glmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 2e+05))
      AIC
                BIC
                       logLik deviance df.resid
1148882.8 1148920.9 -574438.4 1148876.8
Scaled residuals:
    \mathtt{Min}
             1Q Median
                            3Q
-1.0861 -0.2812 -0.2184 -0.1649 18.5164
Random effects:
 Groups
        Name
                     Variance Std.Dev.
 category (Intercept) 0.5648
Number of obs: 2471013, groups: category, 59
Fixed effects:
                Estimate Std. Error z value Pr(>|z|)
(Intercept) -2.087e+02 2.145e-01 -973.2 <2e-16 ***
year_firstpub 1.019e-01 1.162e-04 876.7 <2e-16 ***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Correlation of Fixed Effects:
            (Intr)
year_frstpb -0.909
optimizer (bobyqa) convergence code: 0 (OK)
Model failed to converge with max|grad| = 0.00329572 (tol = 0.002, component 1)
Model is nearly unidentifiable: very large eigenvalue
 - Rescale variables?
Model is nearly unidentifiable: large eigenvalue ratio
 - Rescale variables?
Code sharing:
code_glmer = glmer(is_open_code ~ year_firstpub + (1|category), data = transparency, family =
summary(code_glmer)
Generalized linear mixed model fit by maximum likelihood (Adaptive
  Gauss-Hermite Quadrature, nAGQ = 10) [glmerMod]
```

Family: binomial (logit)

```
Formula: is_open_code ~ year_firstpub + (1 | category)
   Data: transparency
Control: glmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 2e+05))
      AIC
               BIC
                      logLik deviance df.resid
 322897.9 322936.1 -161446.0 322891.9
                                         2471010
Scaled residuals:
          1Q Median
  Min
                        3Q
-0.582 -0.120 -0.087 -0.055 78.146
Random effects:
 Groups
        Name
                    Variance Std.Dev.
 category (Intercept) 1.311
Number of obs: 2471013, groups: category, 59
Fixed effects:
               Estimate Std. Error z value Pr(>|z|)
(Intercept) -4.206e+02 4.208e-01 -999.5 <2e-16 ***
year_firstpub 2.057e-01 2.210e-04 930.9 <2e-16 ***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Correlation of Fixed Effects:
           (Intr)
year_frstpb -0.942
optimizer (bobyqa) convergence code: 0 (OK)
Model failed to converge with max|grad| = 0.0226471 (tol = 0.002, component 1)
Model is nearly unidentifiable: very large eigenvalue
 - Rescale variables?
Model is nearly unidentifiable: large eigenvalue ratio
 - Rescale variables?
```

2.5.3 Appendix 3

Now, min and max for each indicator based on category. For COI disclosure:

```
transparency_by_field %>% arrange(desc(`COI Disclosure %`)) %>% filter(row_number() %in% c(1
```

```
# A tibble: 6 x 2
                      `COI Disclosure %`
  category
  <chr>
                                   <dbl>
1 Rheumatology
                                     98.1
2 Primary Health Care
                                    97.4
3 Emergency Medicine
                                    96.8
4 Neuroimaging
                                    71.5
5 Toxicology
                                     67.5
6 Medicine, Legal
                                     61.6
```

For funding disclosure:

```
transparency_by_field %>% arrange(desc(`Funding disclosure %`)) %>% filter(row_number() %in%
```

```
# A tibble: 6 x 2
  category
                                         `Funding disclosure %`
  <chr>
                                                           <dbl>
1 Neuroimaging
                                                            94.9
2 Materials Science, Biomaterials
                                                            94
3 Audiology & Speech-language Pathology
                                                            93.3
4 Critical Care Medicine
                                                            64.8
                                                            64.7
5 Andrology
6 Medical Laboratory Technology
                                                            60.3
```

Protocol registration:

6 Orthopedics

```
transparency_by_field %>% arrange(desc(`Protocol registration %`)) %>% filter(row_number() %
# A tibble: 6 x 2
                                   `Protocol registration %`
  category
  <chr>>
                                                       <dbl>
                                                        34.5
1 Anesthesiology
2 Rehabilitation
                                                        17.2
3 Critical Care Medicine
                                                        15.2
4 Virology
                                                         1.2
5 Genetics & Heredity
                                                         0.9
6 Materials Science, Biomaterials
                                                         0.3
Data sharing:
transparency_by_field %>% arrange(desc(`Data sharing %`)) %>% filter(row_number() %in% c(1:3
# A tibble: 6 x 2
                      `Data sharing %`
  category
  <chr>
                               <dbl>
1 Genetics & Heredity
                                   37.9
                                  24.7
2 Neuroimaging
3 Virology
                                  23.5
4 Orthopedics
                                   1.6
5 Primary Health Care
                                   1.6
6 Surgery
                                   1.6
Code sharing:
transparency_by_field %>% arrange(desc(`Code sharing %`)) %>% filter(row_number() %in% c(1:3
# A tibble: 6 x 2
  category
                                        `Code sharing %`
  <chr>
                                                   <dbl>
1 Neuroimaging
                                                    12.4
2 Genetics & Heredity
                                                     7.6
3 Medical Informatics
                                                     6.3
4 Integrative & Complementary Medicine
                                                     0.1
5 Nursing
                                                     0.1
```

0.1

2.6 Association with impact factor and number of citations

Adding impact factor variable:

```
impact_factors = read.csv("data/journals.csv")

matches = str_extract(unique_transparency$journalIssn, paste(impact_factors$ISSN, collapse =
matching_rows = !is.na(matches)

unique_transparency$jif2020[matching_rows] = impact_factors$X2020.JIF[match(matches[matching_unique_transparency$jif2020 = as.numeric(unique_transparency$jif2020)
```

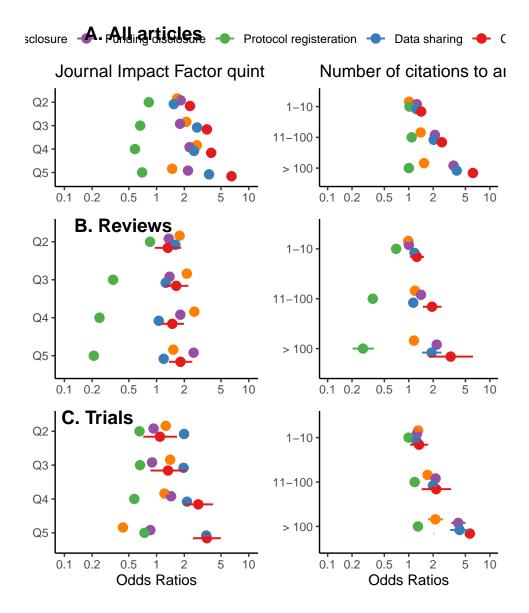
Warning: NAs introduced by coercion

2.6.1 Figure 2

```
terms = paste(as.character(unique(unique_transparency$year_firstpub)), collapse = ", ")
jif_plot = plot_models(coi_jif, fund_jif, reg_jif, data_jif, code_jif, rm.terms = "year_firs"
unique_transparency$citedByCount_4 = factor(ifelse(unique_transparency$citedByCount == 0,"0"
                                         ifelse(unique_transparency$citedByCount >0 & unique_
                                                ifelse(unique_transparency$citedByCount >10 &
                                                       ifelse(unique_transparency$citedByCoun
                                   c("0","1-10","11-100","> 100"))
coi_cite = glm(is_coi_pred ~ citedByCount_4 + year_firstpub, family = "binomial", data = unic
fund_cite = glm(is_fund_pred ~ citedByCount_4 + year_firstpub, family = "binomial", data = us
reg_cite = glm(is_register_pred ~ citedByCount_4 + year_firstpub, family = "binomial", data
data_cite = glm(is_open_data ~ citedByCount_4 + year_firstpub, family = "binomial", data = u
code_cite = glm(is_open_code ~ citedByCount_4 + year_firstpub, family = "binomial", data = u
cite_plot = plot_models(coi_cite, fund_cite, reg_cite, data_cite, code_cite, rm.terms = "yea:
figure2A = ggarrange(jif_plot + theme(legend.title=element_blank()), cite_plot + theme(legend.title=element_blank()),
# Reviews
reviews = unique_transparency %>% filter(is_review == T)
coi_jif_reviews = glm(is_coi_pred ~ jif2020_5 + year_firstpub, family = "binomial", data = re
fund_jif_reviews = glm(is_fund_pred ~ jif2020_5 + year_firstpub, family = "binomial", data =
reg_jif_reviews = glm(is_register_pred ~ jif2020_5 + year_firstpub, family = "binomial", data
data_jif_reviews = glm(is_open_data ~ jif2020_5 + year_firstpub, family = "binomial", data =
code_jif_reviews = glm(is_open_code ~ jif2020_5 + year_firstpub, family = "binomial", data =
jif_plot_reviews = plot_models(coi_jif_reviews, fund_jif_reviews, reg_jif_reviews, data_jif_:
coi_cite_reviews = glm(is_coi_pred ~ citedByCount_4 + year_firstpub, family = "binomial", da
fund_cite_reviews = glm(is_fund_pred ~ citedByCount_4 + year_firstpub, family = "binomial",
reg_cite_reviews = glm(is_register_pred ~ citedByCount_4 + year_firstpub, family = "binomial
data_cite_reviews = glm(is_open_data ~ citedByCount_4 + year_firstpub, family = "binomial",
code_cite_reviews = glm(is_open_code ~ citedByCount_4 + year_firstpub, family = "binomial",
cite_plot_reviews = plot_models(coi_cite_reviews, fund_cite_reviews, reg_cite_reviews, data_
figure2B = ggarrange(jif_plot_reviews + theme(legend.title=element_blank()), cite_plot_review
```

```
# Trials
trials = unique_transparency %>% filter(is_trial == T)
coi_jif_trials = glm(is_coi_pred ~ jif2020_5 + year_firstpub, family = "binomial", data = tr
fund_jif_trials = glm(is_fund_pred ~ jif2020_5 + year_firstpub, family = "binomial", data = '
reg_jif_trials = glm(is_register_pred ~ jif2020_5 + year_firstpub, family = "binomial", data
 data_jif_trials = glm(is_open_data ~ jif2020_5 + year_firstpub, family = "binomial", data = '
code_jif_trials = glm(is_open_code ~ jif2020_5 + year_firstpub, family = "binomial", data = '
jif_plot_trials = plot_models(coi_jif_trials, fund_jif_trials, reg_jif_trials, data_jif_trials)
coi_cite_trials = glm(is_coi_pred ~ citedByCount_4 + year_firstpub, family = "binomial", data
fund_cite_trials = glm(is_fund_pred ~ citedByCount_4 + year_firstpub, family = "binomial", defendable.")
reg_cite_trials = glm(is_register_pred ~ citedByCount_4 + year_firstpub, family = "binomial"
data_cite_trials = glm(is_open_data ~ citedByCount_4 + year_firstpub, family = "binomial", defined the count_4 + year_firstpub, family = year_firs
 code_cite_trials = glm(is_open_code ~ citedByCount_4 + year_firstpub, family = "binomial", defended and the code of the c
 cite_plot_trials = plot_models(coi_cite_trials, fund_cite_trials, reg_cite_trials, data_cite
figure2C = ggarrange(jif_plot_trials + theme(legend.title=element_blank()), cite_plot_trials
figure 2 = ggarrange(figure 2A, figure 2B, figure 2C, ncol = 1, nrow = 3, common.legend = T, laborated and the statement of t
# ggsave("figures/Figure2.png", figure2, dpi = 800, width = 27, height = 30, units = "cm")
# ggsave("figures/Figure2.tiff", figure2, dpi = 800, width = 27, height = 30, units = "cm",
```

figure2



2.7 Publisher differences

Let's take a look at the top most and least transparent publishers in each indicator.

2.7.1 Conflict of interest disclosure

```
unique_transparency %>%
    select(is_coi_pred, scimago_publisher) %>%
```

```
group_by(scimago_publisher) %>%
summarise(coi = sum(is_coi_pred)/n()*100) %>%
arrange(desc(coi)) %>%
head(5)
```

```
# A tibble: 5 x 2
scimago_publisher coi
<chr> <chr> 1 AME Publishing Company 100
2 Academia Nacional de Medicina 100
3 Academy of Medical Sciences of I.R. Iran 100
4 Acta Cardiologica 100
5 American Academy of Pediatrics 100
```

It seems many publishers had 100% transparency. Let's check how many are these:

```
nrow(unique_transparency %>%
    select(is_coi_pred, scimago_publisher) %>%
    group_by(scimago_publisher) %>%
    summarise(coi = sum(is_coi_pred)/n()*100) %>%
    filter(coi == 100))
```

[1] 71

Now, the top lowest adherence:

```
unique_transparency %>%
    select(is_coi_pred, scimago_publisher) %>%
    group_by(scimago_publisher) %>%
    summarise(coi = sum(is_coi_pred)/n()*100) %>%
    arrange(coi) %>%
    head(5)
```

```
# A tibble: 5 x 2
scimago_publisher coi
<chr> <chr> 1 Histology and Histopathology 0
2 International Union of Crystallography 0
3 National Co-ordinating Centre for HTA 0
4 Sociedad Espanola de Medicina Interna (SEMI) 0
5 Sub Rosa 0
```

It seems there are more than one. Let's count them:

```
nrow(unique_transparency %>%
    select(is_coi_pred, scimago_publisher) %>%
    group_by(scimago_publisher) %>%
    summarise(coi = sum(is_coi_pred)/n()*100) %>%
    filter(coi == 0))
```

[1] 8

2.7.2 Funding disclosure

```
unique_transparency %>%
    select(is_fund_pred, scimago_publisher) %>%
    group_by(scimago_publisher) %>%
    summarise(fund = sum(is_fund_pred)/n()*100) %>%
    arrange(desc(fund)) %>%
    head(5)
```

```
unique_transparency %>%
    select(is_fund_pred, scimago_publisher) %>%
    group_by(scimago_publisher) %>%
    summarise(fund = sum(is_fund_pred)/n()*100) %>%
    arrange(fund) %>%
    head(5)
```

```
2 Cairo University 0
3 Deutscher Arzte-Verlag 0
4 Histology and Histopathology 0
5 National Co-ordinating Centre for HTA 0
```

2.7.3 Protocol registration

```
unique_transparency %>%
    select(is_register_pred, scimago_publisher) %>%
    group_by(scimago_publisher) %>%
    summarise(register = sum(is_register_pred)/n()*100) %>%
    arrange(desc(register)) %>%
    head(5)
```

```
unique_transparency %>%
    select(is_register_pred, scimago_publisher) %>%
    group_by(scimago_publisher) %>%
    summarise(register = sum(is_register_pred)/n()*100) %>%
    arrange(register) %>%
    head(5)
```

2.7.4 Data sharing

```
unique_transparency %>%
    select(is_open_data, scimago_publisher) %>%
    group_by(scimago_publisher) %>%
    summarise(data = sum(is_open_data)/n()*100) %>%
    arrange(desc(data)) %>%
    head(5)
```

```
unique_transparency %>%
    select(is_open_data, scimago_publisher) %>%
    group_by(scimago_publisher) %>%
    summarise(data = sum(is_open_data)/n()*100) %>%
    arrange(data) %>%
    head(5)
```

2.7.5 Code sharing

```
unique_transparency %>%
    select(is_open_code, scimago_publisher) %>%
```

```
group_by(scimago_publisher) %>%
summarise(code = sum(is_open_code)/n()*100) %>%
arrange(desc(code)) %>%
head(5)
```

```
unique_transparency %>%
    select(is_open_code, scimago_publisher) %>%
    group_by(scimago_publisher) %>%
    summarise(code = sum(is_open_code)/n()*100) %>%
    arrange(code) %>%
    head(5)
```