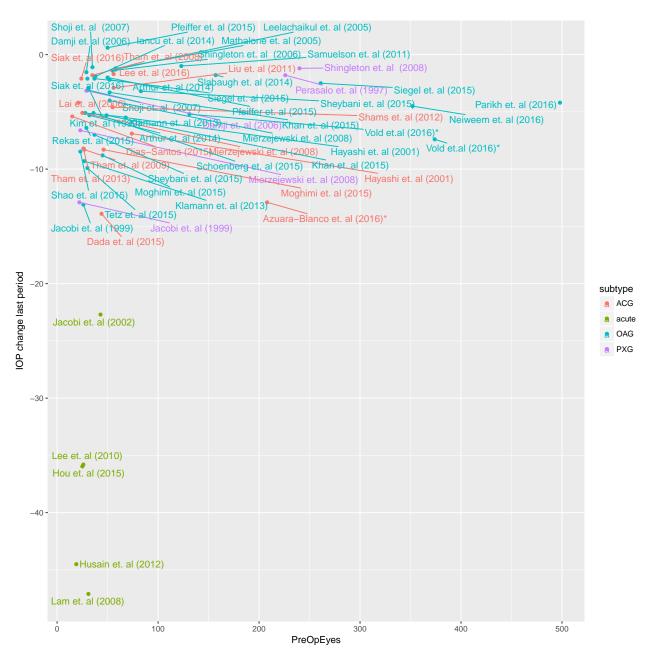
Sanity checks

Sanity check data graphically

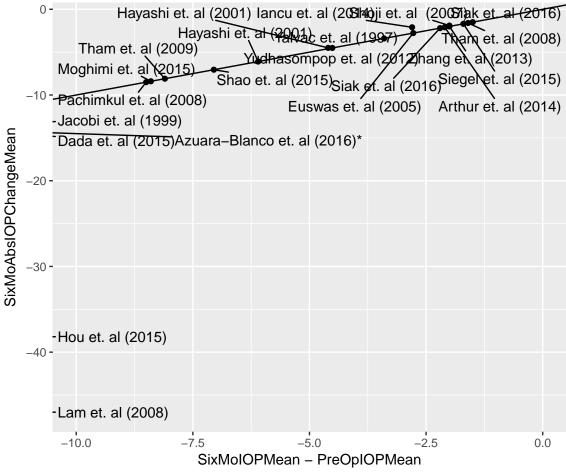
```
library(ggplot2)
library(ggrepel)
source("read-data.R")
## Attaching package: 'dplyr'
## The following object is masked from 'package:testthat':
##
       matches
## The following objects are masked from 'package:stats':
##
       filter, lag
## The following objects are masked from 'package:base':
##
       intersect, setdiff, setequal, union
## In anonymous test function
## This study only has some eye number information missing, fix it:
## Vold et.al (2016)*
df <- read.data()</pre>
## This study only has some eye number information missing, fix it:
## Vold et.al (2016)*
Summary plot.
ggplot(df, aes(x = PreOpEyes, y =
                 ifelse(!is.na(LastPeriodIOPMean) & !is.na(PreOpIOPMean),
                        LastPeriodIOPMean - PreOpIOPMean,
                        ifelse(!is.na(LastPeriodAbsIOPChangeMean),
                               LastPeriodAbsIOPChangeMean,
                               ifelse(!is.na(OneYAbsIOPChangeMean),
                                       OneYAbsIOPChangeMean,
                                       OneYIOPMean - PreOpIOPMean
                                , label = study.name, color = subtype)) + geom_point() + ylab('IOP chang
## Warning: Removed 7 rows containing missing values (geom_point).
## Warning: Removed 7 rows containing missing values (geom_text_repel).
```



Check that changes add up.

```
ggplot(df, aes(x = SixMoIOPMean - PreOpIOPMean, y = SixMoAbsIOPChangeMean, label = study.name)) +
  geom_point() +
  coord_cartesian(xlim=c(-10, 0)) +
  geom_abline() +
  geom_text_repel()
```

- ## Warning: Removed 44 rows containing missing values (geom_point).
- ## Warning: Removed 44 rows containing missing values (geom_text_repel).



* Hayashi et al. rejected patients they couldn't follow for 12 months * Yudhasompop was retrospective * Iancu has full follow up * Shoji had low follow up loss * Yalvac was retrospective

Working model: if there's a delta, and no annotation for number of eyes, it's retrospective. Sanity check: the delta should be 0

```
df %>% mutate(delta.sixMo = SixMoIOPMean - PreOpIOPMean - SixMoAbsIOPChangeMean) %>%
    filter(!is.na(delta.sixMo)) %>%
    select(study.name, subtype, delta.sixMo, PreOpEyes, SixMoEyes)
```

##		study.nam	e subtype	delta.sixMo	PreOpEyes	SixMoEyes
##	1	Yalvac et. al (1997) OAG	1.332268e-15	35	35
##	2	Jacobi et. al (1999) PXG	0.000000e+00	22	17
##	3	Hayashi et. al (2001) OAG	-1.000000e-01	68	68
##	4	Hayashi et. al (2001) ACG	1.776357e-15	74	74
##	5	Euswas et. al (2005) ACG	3.552714e-15	48	48
##	6	Shoji et. al (2007) OAG	-1.000000e-01	35	35
##	7	Lam et. al (2008) acute	0.000000e+00	31	31
##	8	Pachimkul et. al (2008) ACG	0.000000e+00	58	58
##	9	Tham et. al (2008) ACG	0.000000e+00	35	35
##	10	Tham et. al (2009) ACG	0.000000e+00	27	27
##	11	Yudhasompop et. al (2012) ACG	-1.776357e-15	60	60
##	12	Zhang et. al (2013) OAG	0.000000e+00	43	43
##	13	Arthur et. al (2014) OAG	0.000000e+00	37	36
##	14	Iancu et. al (2014) OAG	-7.000000e-01	38	38
##	15	Dada et. al (2015) ACG	0.000000e+00	44	44

```
## 16
                  Hou et. al (2015)
                                       acute 0.000000e+00
                                                                    25
                                                                               25
## 17
                                         ACG
                                              0.000000e+00
                                                                    46
                                                                               46
             Moghimi et. al (2015)
                                              0.000000e+00
## 18
                 Shao et. al (2015)
                                         ACG
                                                                    20
                                                                               20
## 19
              Siegel et. al (2015)
                                         OAG
                                              0.000000e+00
                                                                    52
                                                                              52
## 20 Azuara-Blanco et. al (2016)*
                                         ACG
                                              0.000000e+00
                                                                   208
                                                                             195
## 21
                Siak et. al (2016)
                                              0.000000e+00
                                                                              24
                                         ACG
                                                                    24
## 22
                Siak et. al (2016)
                                         OAG
                                              0.000000e+00
                                                                               30
                                                                    30
```

Also: the number from Iancy don't match up 100%. Likely source: sloppy math.

Let's see what happens at one year.

```
df %>% mutate(delta.OneY = OneYIOPMean - PreOpIOPMean - OneYAbsIOPChangeMean) %>%
  filter(!is.na(delta.OneY)) %>%
  select(study.name, subtype, delta.OneY, PreOpEyes, OneYEyes)
```

##		study.name	subtype	delta.OneY	PreOpEyes	OneYEyes
##	1	Perasalo et. al (1997)	PXG	0.000000e+00	226	127
##	2	Jacobi et. al (1999)	PXG	0.000000e+00	22	16
##	3	Hayashi et. al (2001)	OAG	-1.000000e-01	68	68
##	4	Hayashi et. al (2001)	ACG	-1.000000e-01	74	74
##	5	Leelachaikul et. al (2005)	OAG	-4.440892e-16	58	58
##	6	Mathalone et. al (2005)	OAG	0.000000e+00	58	34
##	7	Shoji et. al (2007)	OAG	-2.000000e-01	35	32
##	8	Lam et. al (2008)	acute	0.000000e+00	31	31
##	9	Shingleton et. al (2008)	PXG	0.000000e+00	240	111
##	10	Tham et. al (2008)	ACG	0.000000e+00	35	35
##	11	Tham et. al (2009)	ACG	0.000000e+00	27	27
##	12	Liu et. al (2011)	ACG	0.000000e+00	56	56
##	13	Arthur et. al (2014)	OAG	0.000000e+00	37	34
##	14	Iancu et. al (2014)	OAG	-3.000000e-01	38	38
##	15	Slabaugh et. al (2014)	OAG	-1.000000e-02	157	157
##	16	Dada et. al (2015)	ACG	0.000000e+00	44	44
##	17	Hou et. al (2015)	acute	0.000000e+00	25	25
##	18	Moghimi et. al (2015)	ACG	0.000000e+00	46	46
##	19	Pfeiffer et. al (2015)	OAG	0.000000e+00	50	44
##	20	Siegel et. al (2015)	OAG	0.000000e+00	52	52
##	21	Azuara-Blanco et. al (2016)*	ACG	0.000000e+00	208	192
##	22	Siak et. al (2016)	ACG	0.000000e+00	24	24
##	23	Siak et. al (2016)	OAG	0.000000e+00	30	30

Problem with assumption: Mathalone doesn't fit this pattern.

- Mathalone is retrospective
- The measured IOPs are actually for those in the followed-up group (N = 34)
- TODO(Patrick): fix the coding.

At the last point in the study:

```
df %>% mutate(delta.LastPeriod = LastPeriodIOPMean - PreOpIOPMean - LastPeriodAbsIOPChangeMean) %>%
    filter(!is.na(delta.LastPeriod)) %>%
    select(study.name, subtype, delta.LastPeriod, PreOpEyes, LastPeriodEyes)
```

```
##
                         study.name subtype delta.LastPeriod PreOpEyes
## 1
                                                 0.000000e+00
              Jacobi et. al (1999)
                                         PXG
                                                                      22
## 2
              Jacobi et. al (1999)
                                         OAG
                                                 0.00000e+00
                                                                      26
## 3
                  Kim et. al (1999)
                                         OAG
                                                 0.00000e+00
                                                                      31
## 4
             Hayashi et. al (2001)
                                         OAG
                                                -2.000000e-01
                                                                      68
```

```
## 5
             Havashi et. al (2001)
                                          ACG
                                                   3.000000e-01
                                                                        74
## 6
               Jacobi et. al (2002)
                                                                        43
                                                   0.000000e+00
                                        acute
## 7
        Leelachaikul et. al (2005)
                                          OAG
                                                   3.000000e-01
                                                                        58
## 8
           Mathalone et. al (2005)
                                          OAG
                                                   7.00000e-01
                                                                        58
## 9
                  Lai et. al (2006)
                                          ACG
                                                   0.000000e+00
                                                                        21
## 10
                                                                        35
               Shoji et. al
                              (2007)
                                          OAG
                                                  -1.000000e-01
## 11
               Shoji et. al
                              (2007)
                                          OAG
                                                   0.000000e+00
                                                                        31
## 12
                  Lam et. al (2008)
                                        acute
                                                   0.000000e+00
                                                                        31
## 13
        Mierzejewski et. al (2008)
                                          OAG
                                                  -1.776357e-15
                                                                        52
## 14
                                                                        25
        Mierzejewski et. al (2008)
                                          ACG
                                                   0.00000e+00
##
  15
        Mierzejewski et. al (2008)
                                          PXG
                                                   0.000000e+00
                                                                        23
##
  16
                                          PXG
                                                                       240
         Shingleton et. al
                              (2008)
                                                   0.000000e+00
##
  17
                 Tham et. al (2008)
                                          ACG
                                                   0.000000e+00
                                                                        35
## 18
                 Tham et. al (2009)
                                          ACG
                                                   0.000000e+00
                                                                        27
## 19
                  Lee et. al (2010)
                                                                        26
                                        acute
                                                   0.00000e+00
## 20
               Husain et. al (2012)
                                        acute
                                                   0.00000e+00
                                                                        19
##
  21
                                                                        55
                Shams et. al (2012)
                                          ACG
                                                  -1.000000e-01
  22
##
             Klamann et. al (2013)
                                          OAG
                                                   0.000000e+00
                                                                        28
## 23
                                          OAG
                                                   0.000000e+00
                                                                        27
             Klamann et. al (2013)
## 24
                 Tham et. al (2013)
                                          ACG
                                                   2.000000e-01
                                                                        26
##
  25
               Arthur et. al (2014)
                                          OAG
                                                   0.000000e+00
                                                                        37
## 26
               Arthur et. al (2014)
                                          OAG
                                                   0.000000e+00
                                                                        32
## 27
                 Dias-Santos (2015)
                                          ACG
                                                   0.00000e+00
                                                                        15
##
  28
                 Khan et. al (2015)
                                                                        49
                                          OAG
                                                   0.000000e+00
## 29
                                                                        52
                 Khan et. al (2015)
                                          OAG
                                                   0.000000e+00
##
  30
             Moghimi et. al (2015)
                                          OAG
                                                   0.000000e+00
                                                                        45
##
  31
             Pfeiffer et. al (2015)
                                          OAG
                                                   0.00000e+00
                                                                        50
##
   32
                                                                        50
             Pfeiffer et. al (2015)
                                          OAG
                                                   0.000000e+00
## 33
                                                                        29
                Rekas et. al (2015)
                                          OAG
                                                   0.000000e+00
## 34
           Schoenberg et. al (2015)
                                          OAG
                                                   0.000000e+00
                                                                        36
## 35
                 Shao et. al (2015)
                                          OAG
                                                   0.000000e+00
                                                                        23
##
  36
             Sheybani et. al (2015)
                                          OAG
                                                   0.00000e+00
                                                                        83
##
  37
             Sheybani et. al (2015)
                                          OAG
                                                   0.00000e+00
                                                                        37
##
  38
                                          OAG
                                                                        52
               Siegel et. al (2015)
                                                   0.00000e+00
##
   39
               Siegel et. al (2015)
                                          OAG
                                                   0.000000e+00
                                                                       261
##
  40
                 Tetz et. al (2015)
                                          OAG
                                                                        30
                                                   0.00000e+00
      Azuara-Blanco et. al (2016)*
                                          ACG
                                                   0.00000e+00
                                                                       208
## 42
                  Lee et. al (2016)
                                          ACG
                                                  -2.220446e-16
                                                                        56
## 43
             Neiweem et. al (2016)
                                          OAG
                                                   0.000000e+00
                                                                       352
##
  44
               Parikh et. al (2016)
                                          OAG
                                                   0.00000e+00
                                                                       498
##
   45
                 Vold et.al (2016)*
                                                   2.000000e-01
                                          OAG
                                                                       131
##
   46
                 Vold et.al (2016)*
                                          OAG
                                                   1.776357e-15
                                                                       374
##
      LastPeriodEyes
## 1
                   13
## 2
                   13
## 3
                   31
## 4
                   68
## 5
                   74
## 6
                   43
## 7
                   54
## 8
                   24
## 9
                   21
## 10
                   20
## 11
                   16
```

```
## 12
                    31
## 13
                    52
## 14
                    25
                    23
## 15
## 16
                    22
## 17
                    35
## 18
                    27
## 19
                    26
## 20
                    18
                    55
## 21
## 22
                    28
                    27
## 23
## 24
                    26
## 25
                    17
## 26
                    11
## 27
                    15
## 28
                    49
## 29
                    52
## 30
                    45
## 31
                    43
## 32
                    47
## 33
                    29
## 34
                    36
## 35
                    23
## 36
                    83
## 37
                    34
## 38
                    52
## 39
                   261
## 40
                    27
## 41
                   182
## 42
                    56
## 43
                   352
## 44
                   498
## 45
                   131
                   374
```

That fits into this general pattern. Now let's look at those with no delta (only absolutes).

```
df %>% filter(is.na(SixMoAbsIOPChangeMean) & !is.na(SixMoIOPMean)) %>%
    select(study.name, subtype, PreOpIOPMean, SixMoIOPMean, PreOpEyes, SixMoEyes)
```

```
## [1] study.name subtype PreOpIOPMean SixMoIOPMean PreOpEyes
## [6] SixMoEyes
## <0 rows> (or 0-length row.names)
```

- Euswas is retrospective
- Lam had full follow up except one eye that died after 17 months (lung cancer)
- Pachimkul was prospective and had full follow up

Generally however, the SixMoEyes annotation is much more likely in prospective studies than in retrospective studies.

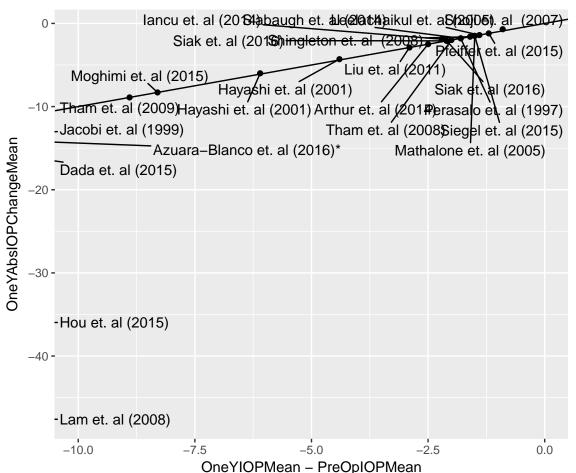
Plan:

- Impute PutativePropective from pattern of eye studies
- Redo the analysis based on this distinction to see whether it matters much
- Annotate pro or retro in the dataset

- Hound the N eyes values
- Annotate mechanism of exclusion (only included follow through..., or whatever)

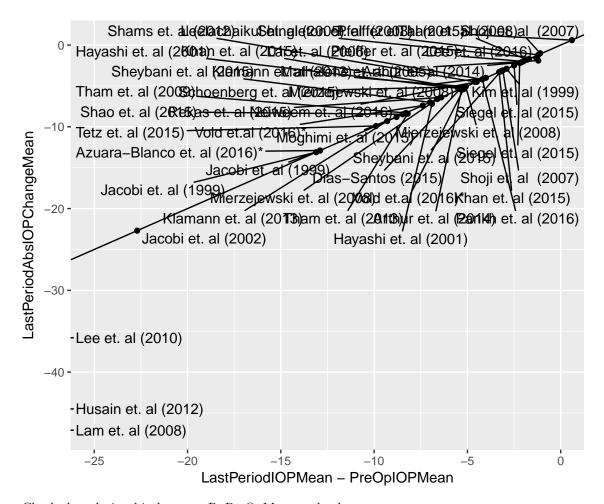
```
ggplot(df, aes(x = OneYIOPMean - PreOpIOPMean, y = OneYAbsIOPChangeMean, label = study.name)) +
geom_point() +
coord_cartesian(xlim=c(-10, 0)) +
geom_abline() +
geom_text_repel()
```

- ## Warning: Removed 43 rows containing missing values (geom_point).
- ## Warning: Removed 43 rows containing missing values (geom_text_repel).



```
ggplot(df, aes(x = LastPeriodIOPMean - PreOpIOPMean, y = LastPeriodAbsIOPChangeMean, label = study.name
  geom_point() +
  coord_cartesian(xlim=c(-25, 0)) +
  geom_abline() +
  geom_text_repel()
```

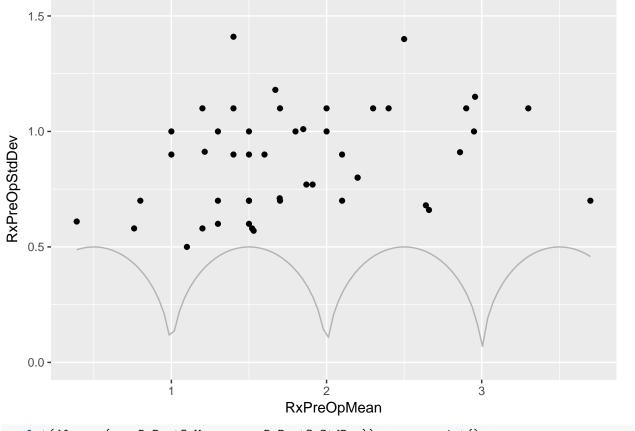
- ## Warning: Removed 20 rows containing missing values (geom_point).
- ## Warning: Removed 20 rows containing missing values (geom_text_repel).



Check the relationship between RxPreOpMean and s.d.

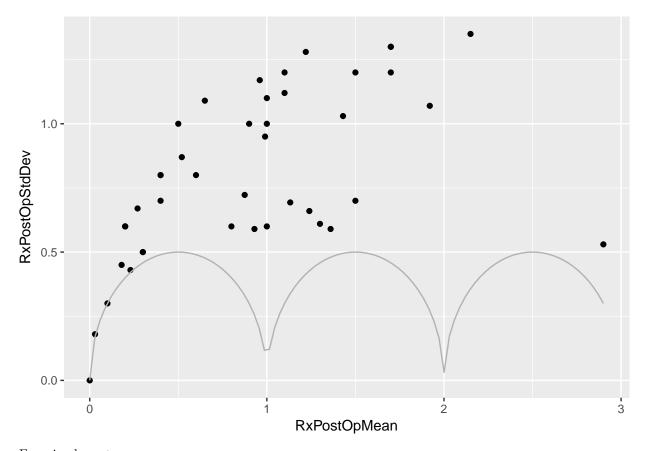
```
ggplot(df, aes(x = RxPreOpMean, y = RxPreOpStdDev)) +
  geom_point() +
  coord_cartesian(y=c(0, 1.5)) +
  stat_function(fun = function(x) sqrt((x - floor(x)) * (1 - (x - floor(x)))), color="gray70")
```

Warning: Removed 18 rows containing missing values (geom_point).



```
ggplot(df, aes(x = RxPostOpMean, y = RxPostOpStdDev)) + geom_point() +
    stat_function(fun = function(x) sqrt((x - floor(x)) * (1 - (x - floor(x)))), color="gray70")
```

Warning: Removed 23 rows containing missing values (geom_point).



Examine loss at one year.

```
ggplot(df, aes(x=PreOpEyes, y=OneYEyes, label=study.name)) +
  geom_point(color="red") +
  geom_abline() +
  geom_text_repel() + coord_cartesian(xlim=c(0, 250), ylim=c(0, 250))
```

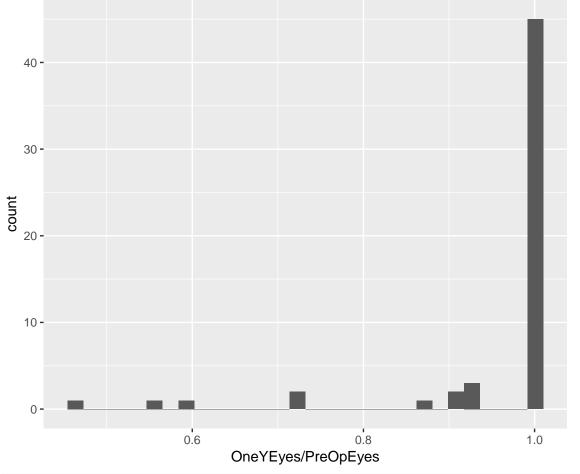
Warning: Removed 10 rows containing missing values (geom_point).

Warning: Removed 10 rows containing missing values (geom_text_repel).

```
Neiweem et. al (2016) Parikh et. al (20
   250 -
                                                                           Vold et.al
                                                                    Siegel et. al (2015)
   200 -
                                                              Azuara-Blanco et. al (2016)*
         Zhang et. al (2013) hingleton et. al (2006) Slabaugh et. al (2014)
                                                            /pld_et.al (2016)*
   150
                      (250/1544) as et. al (24060/55) shi et. al (2000
         Iancu et. al
OneYEyes
         Dada et.
                      (2015) udhasom/pop et.
                                                                     Perasalo et. al (1997)
                                           (2∕0158′amuelson et. al (2011)
                                                                Shingleton et. al (2008)
        Tham et.
                                           bani et. alle@larcs)aikul et. al (2005)
         Schoenbe
                                                                Pachimkul et. al (2008)
         Lee et. al
         Klamann
                                                 al (25) ite2) el et. al (20175) iffer et. al (2015)
    50 - Tham et.
                                             06% bji et. al (2007) Yalvac et. al (1997)
                                        <del>(2015) et. al (2008) -</del> Kim et. al (1999)
                                         al (2008) al (2004) et. al (2008)
                     2031536 etMae(20155)ski d(1211/2008), al M2011/3)one et. al (2005)
                           all 42016 5 et. all 489 5 en to s D 2017 5 et. all 420 20 ewski et. al (2008)
                                                                         200
                                                                                         250
           Ö
                          50
                                          100
                                                         150
                                             PreOpEyes
ggplot(df, aes(x=OneYEyes / PreOpEyes, label=study.name)) +
  geom_histogram() +
  coord_cartesian()
```

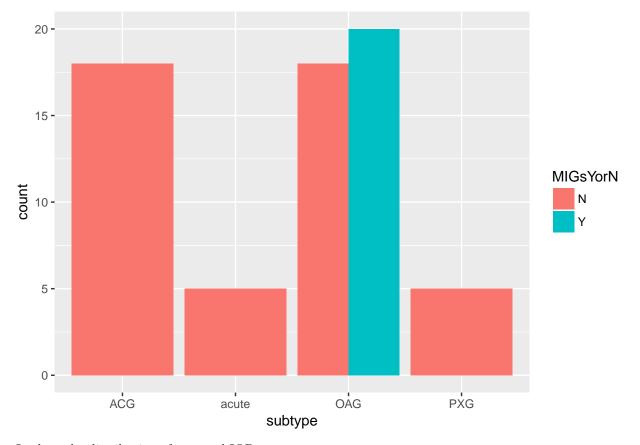
```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

^{##} Warning: Removed 10 rows containing non-finite values (stat_bin).



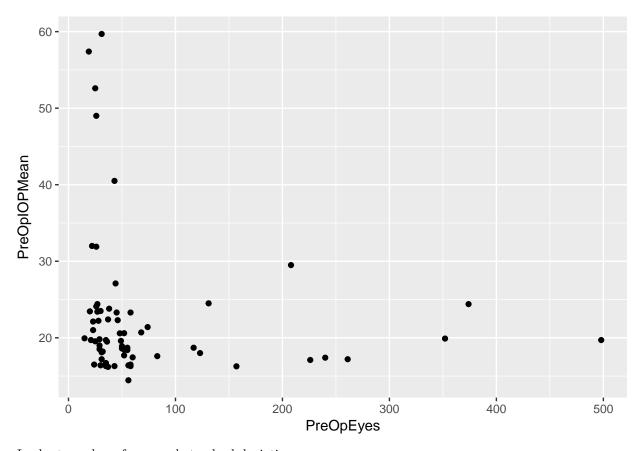
ggplot(df, aes(x=subtype, fill=MIGsYorN)) + geom_histogram(stat="count", position = 'dodge')

Warning: Ignoring unknown parameters: binwidth, bins, pad



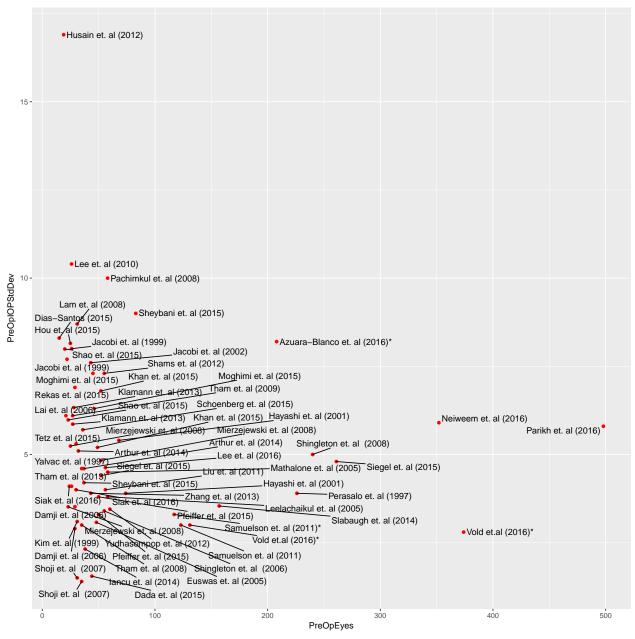
Look at the distribution of eyes and IOP means.

ggplot(df, aes(x=PreOpEyes, y=PreOpIOPMean)) + geom_point()



Look at number of eyes and standard deviation.

ggplot(df, aes(x=PreOpEyes, y=PreOpIOPStdDev, label=study.name)) + geom_point(color="red") + geom_text_



ggplot(df, aes(x=PreOpEyes, y=SixMoAbsIOPChangeStdDev, label=study.name)) + geom_point(color="red") + g

Warning: Removed 41 rows containing missing values (geom_point).

Warning: Removed 41 rows containing missing values (geom_text_repel).

```
12.5 -
                Pachimkul et. al (2008)
             Lam et. al (2008)
           Hou et. al (2015)
                                 Aguara-Blanco et. al (2016)*
          Jacobi et. al (1999)
   10.0 -
            Shao et. al (2015)
SixMoAbsIOPChangeStdDev
             Moghimi et. al (2015)
     7.5 -
             Tham et. al (2009)
         Arthur et. al (2014)
                          Siegel et. al (2015)
                            Damji et. al (2006)
              Siak et. al (2016) hang et. al (2013)
    5.0 -
                  Tham et. al (2011)
               lancu et. al/al/al/al/t. al (1997) às et. al (2005)
             Tham et. al (2001)
          Damji et. al (2006) asompop et. al (2012)
             Shoji et. al (2007)
                    Dada et. al (2015)
         Ö
                    100
                                 200
                                             300
                                                         400
                                                                      500
                                   PreOpEyes
```

```
ggplot(df, aes(x=PreOpEyes, y=SixMoIOPStdDev, label=study.name)) + geom_point(color="red") + geom_text_:
## Warning: Removed 44 rows containing missing values (geom_point).
```

Warning: Removed 44 rows containing missing values (geom_text_repel).

```
• Pachimkul et. al (2008)
   6 -
         •Shao et. al (2015)
   5 -
SixMolOPStdDev
        Hayashi et. al (2001)
                                  Azuara-Blanco et. al (2016)*
         Moghimi et. al (2015)
      Tham et al (2009) Siegel et. al (2015)
           Siak et. al (2016) rthur et. al (2014)
               Lam et. al (2008) Zhang et. al (2013)
        Hou et. al (2016) Ivac et. al (1997)
      Tham et. al (2008) Hayashi et. al (2001)
                     Shoji et. al Y(201025)ompop et. al (2012)
                 -Tancu et. al (2014)
      Siak et. al (2016)

    Jacobi et. al (1999)

                              Euswas et. al (2005)
            Dada et. al (2015)
                                              300
                   100
                                200
                                                           400
                                                                         500
                                   PreOpEyes
```

```
ggplot(df, aes(x=PreOpEyes, y=OneYAbsIOPChangeStdDev, label=study.name)) + geom_point(color="red") + ge
## Warning: Removed 38 rows containing missing values (geom_point).
```

Warning: Removed 38 rows containing missing values (geom_text_repel).

```
Azuara-Blanco et. al (2016)*
          Hou et. al (2015)
          •Jacobi et. al (1999)
           Moghimi et. al (2015)
OneYAbsIOPChangeStdDev
             Tham et. al (2009)
           Tham et. al (2013)
       Arthur et.
                                       Shingleton et. al (2008)
                   Siegel et. al (2015)
            Slak et al (2016) Mathalone et. al (2005)
                Pfeiffer et. al (2015)Perasalo et. al (1997)
                                                           Vold et.al (2016)*
                   Lade Add Roll kul et. al (2000 5).al (2016)*
        Hayashi et. al (2001 Samuelson et. al (2011)
       Tham et. al (2008) Slabaugh et. al (2014)
           Damii et. al (2006)
           Shoji et. al (2007)
    2 -

    Dada et. al (2015)

      Ö
                   100
                                 200
                                              300
                                                            400
                                                                         500
                                    PreOpEyes
```

•Lam et. al (2008)

ggplot(df, aes(x=PreOpEyes, y=OneYIOPStdDev, label=study.name)) + geom_point(color="red") + geom_text_r
Warning: Removed 44 rows containing missing values (geom_point).
Warning: Removed 44 rows containing missing values (geom_text_repel).

```
Shingleton et. al (2008)

    Hayashi et. al (2001)

           Moghimi et. al (2015)
      Pfeiffer et al (2015)
                     Hayashi et. al (2001)
      Siak et. al (2016)
                                Slabaugh et. al (2014)
             Siegel et. al (2015)
         Arthur et. al (2014) Azuara-Blanco et. al (2016)*
OneYIOPStdDev
      How et. al (270 mass) et. al (2009)
                                    Perasalo et. al (1997)
           Tham et. al (2008)
                    -Shoji et. al (2007)
          Lam et. al (2008) thalone et. al (2005)
          Siak et. al (2046)achaikul et. al (2005)
        lancu et. al (2014)
   2 -

    Jacobi et. al (1999)

    Dada et. al (2015)

                  100
                                200
                                              300
                                                           400
                                                                         500
                                   PreOpEyes
```

ggplot(df, aes(x=PreOpEyes, y=LastPeriodAbsIOPChangeStdDev, label=study.name)) + geom_point(color="red"
Warning: Removed 17 rows containing missing values (geom_point).

```
    Husain et. al (2012)

LastPeriodAbsIOPChangeStdDev
       Lee et. al (2010)
       Lam et. al (2008) Sheybani et. al (2015)
           Jacobi et. al (1999) as-Santos (2015)
                            -al (20145)ghimi et. al (2015)
                             Klamann et. al,
                                                   -Blanco et. al (2016)*
                                         hoenberg et. al (2015)
                                   tamann et. Sahi(2001 et. al (2008)
                                          alia 1201 5). as (2005)t. al (2015)
                           (2016)*
                                     Hayashi et. al (2000dl)d et.al (2016)*
          Shoji et. al (2007) acobi et. al (2002) Mierzejewski et. al (2008)
                  Shoji et. al (2007) hingleton et. al (2006)
       0
                               200
                   100
                                            300
                                                        400
                                                                     500
                                  PreOpEyes
ggplot(df, aes(x=PreOpEyes, y=SixMoIOPStdDev, label=study.name)) + geom_point(color="red") + geom_text_
## Warning: Removed 44 rows containing missing values (geom_point).
```

Warning: Removed 44 rows containing missing values (geom_text_repel).

