Full dataset analysis

First read in all of the relevant data.

```
all_ws_1 <-
  readInWebCDI(all_data_ws1_path) %>%
  select( #drop a bunch of columns that were screwing up the merge with prolific data
    -opt_out,
    -country,
    -sibling_boolean,
    -sibling_data,
    -sibling_count,
    -caregiver_other
  )
```

```
## Warning: Problem with `mutate()` input `Total Produced Percentile-sex`.
## i NAs introduced by coercion
## i Input `Total Produced Percentile-sex` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) .

## Warning in eval_tidy(pair$rhs, env = default_env): NAs introduced by coercion

## Warning: Problem with `mutate()` input `Total Produced Percentile-both`.
## i NAs introduced by coercion
## i Input `Total Produced Percentile-both` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1)

## Warning in eval_tidy(pair$rhs, env = default_env): NAs introduced by coercion

## Warning: Problem with `mutate()` input `Complexity Percentile-sex`.
## i NAs introduced by coercion
## i Input `Complexity Percentile-sex` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) ...`.

## Warning in eval_tidy(pair$rhs, env = default_env): NAs introduced by coercion

## Warning: Problem with `mutate()` input `Combination Example 1`.
## i NAs introduced by coercion
## i Input `Combination Example 1` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) ...`.

## Warning in ~as.numeric(.): NAs introduced by coercion

## Warning: Problem with `mutate()` input `Combination Example 2`.
## i NAs introduced by coercion
## i Input `Combination Example 2` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) ...`.

## Warning in ~as.numeric(.): NAs introduced by coercion
```

```
## Warning: Problem with `mutate()` input `Combination Example 3`.
## i NAs introduced by coercion
## i Input `Combination Example 3` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) ...`.

## Warning in ~as.numeric(.): NAs introduced by coercion

## Warning: Problem with `mutate()` input `other_languages`.
## i NAs introduced by coercion
## i Input `other_languages` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) ...`.

## Warning in ~as.numeric(.): NAs introduced by coercion

## Warning: Problem with `mutate()` input `language_from`.
## i NAs introduced by coercion
## i Input `language_from` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) ...`.

## Warning in ~as.numeric(.): NAs introduced by coercion
```

```
all_ws_2 <-
  readInWebCDI(all_data_ws2_path) %>%
  select( #drop a bunch of columns that were screwing up the merge with prolific data
    -opt_out,
    -country,
    -sibling_boolean,
    -sibling_data,
    -sibling_count,
    -caregiver_other
  )
```

```
## Warning: Problem with `mutate()` input `Total Produced Percentile-sex`.
## i NAs introduced by coercion
## i Input `Total Produced Percentile-sex` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) .

## Warning in eval_tidy(pair$rhs, env = default_env): NAs introduced by coercion

## Warning: Problem with `mutate()` input `Total Produced Percentile-both`.
## i NAs introduced by coercion
## i Input `Total Produced Percentile-both` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1)

## Warning in eval_tidy(pair$rhs, env = default_env): NAs introduced by coercion

## Warning: Problem with `mutate()` input `Complexity Percentile-sex`.
## i NAs introduced by coercion
## i Input `Complexity Percentile-sex` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) ...`.

## Warning in eval_tidy(pair$rhs, env = default_env): NAs introduced by coercion

## Warning: Problem with `mutate()` input `Combination Example 1`.
## i NAs introduced by coercion
## i Input `Combination Example 1` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) ...`.
```

```
## Warning in ~as.numeric(.): NAs introduced by coercion

## Warning: Problem with `mutate()` input `Combination Example 2`.
## i NAs introduced by coercion
## i Input `Combination Example 2` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) ...`.

## Warning in ~as.numeric(.): NAs introduced by coercion

## Warning: Problem with `mutate()` input `Combination Example 3`.
## i NAs introduced by coercion
## i Input `Combination Example 3` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) ...`.

## Warning in ~as.numeric(.): NAs introduced by coercion

## Warning: Problem with `mutate()` input `other_languages`.
## i NAs introduced by coercion
## i Input `other_languages` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) ...`.

## Warning in ~as.numeric(.): NAs introduced by coercion

## Warning: Problem with `mutate()` input `language_from`.
## i NAs introduced by coercion
## i Input `language_from` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) ...`.

## Warning in ~as.numeric(.): NAs introduced by coercion
```

```
all_ws_raw <-
  all_ws_1 %>%
  bind_rows(all_ws_2) %>%
  mutate(completed = case_when(
    stringr::str_to_lower(completed) == "true" ~ TRUE,
    stringr::str_to_lower(completed) == "false" ~ FALSE
  ))

all_wg_raw <- readInWebCDI(all_data_wg_path)
```

```
## Warning: Problem with `mutate()` input `Phrases Percentile-sex`.
## i NAs introduced by coercion
## i Input `Phrases Percentile-sex` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) ...`.

## Warning in eval_tidy(pair$rhs, env = default_env): NAs introduced by coercion

## Warning: Problem with `mutate()` input `Words Understood Percentile-sex`.
## i NAs introduced by coercion
## i Input `Words Understood Percentile-sex` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1)

## Warning in eval_tidy(pair$rhs, env = default_env): NAs introduced by coercion

## Warning: Problem with `mutate()` input `Words Understood Percentile-both`.
## i NAs introduced by coercion
## i Input `Words Understood Percentile-both` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1
```

```
## Warning in eval_tidy(pair$rhs, env = default_env): NAs introduced by coercion

## Warning: Problem with `mutate()` input `Words Produced Percentile-sex`.
## i NAs introduced by coercion
## i Input `Words Produced Percentile-sex` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) .

## Warning in eval_tidy(pair$rhs, env = default_env): NAs introduced by coercion

## Warning: Problem with `mutate()` input `Words Produced Percentile-both`.
## i NAs introduced by coercion
## i Input `Words Produced Percentile-both` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1)

## Warning in eval_tidy(pair$rhs, env = default_env): NAs introduced by coercion

## Warning: Problem with `mutate()` input `Early Gestures Percentile-sex`.
## i NAs introduced by coercion
## i Input `Early Gestures Percentile-sex` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) .

## Warning in eval_tidy(pair$rhs, env = default_env): NAs introduced by coercion

## Warning: Problem with `mutate()` input `Early Gestures Percentile-both`.
## i NAs introduced by coercion
## i Input `Early Gestures Percentile-both` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1)

## Warning in eval_tidy(pair$rhs, env = default_env): NAs introduced by coercion

## Warning: Problem with `mutate()` input `Later Gestures Percentile-sex`.
## i NAs introduced by coercion
## i Input `Later Gestures Percentile-sex` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) .

## Warning in eval_tidy(pair$rhs, env = default_env): NAs introduced by coercion

## Warning: Problem with `mutate()` input `Later Gestures Percentile-both`.
## i NAs introduced by coercion
## i Input `Later Gestures Percentile-both` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1)

## Warning in eval_tidy(pair$rhs, env = default_env): NAs introduced by coercion

## Warning: Problem with `mutate()` input `Total Gestures Percentile-sex`.
## i NAs introduced by coercion
## i Input `Total Gestures Percentile-sex` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) .

## Warning in eval_tidy(pair$rhs, env = default_env): NAs introduced by coercion

## Warning: Problem with `mutate()` input `Total Gestures Percentile-both`.
## i NAs introduced by coercion
## i Input `Total Gestures Percentile-both` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1)

## Warning in eval_tidy(pair$rhs, env = default_env): NAs introduced by coercion
```

```
## Warning: Problem with `mutate()` input `other_languages`.
## i NAs introduced by coercion
## i Input `other_languages` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) ...`.

## Warning in ~as.numeric(.): NAs introduced by coercion

## Warning: Problem with `mutate()` input `language_from`.
## i NAs introduced by coercion
## i Input `language_from` is `(structure(function (..., .x = ..1, .y = ..2, . = ..1) ...`.

## Warning in ~as.numeric(.): NAs introduced by coercion
```

```
save(
  all_ws_raw,
  file = path(
    project_root,
    "data",
    "full_dataset",
    "unfiltered",
    "ws_unfiltered.RData"
  )
)

save(
  all_wg_raw,
  file = path(
    project_root,
    "data",
    "full_dataset",
    "unfiltered",
    "wg_unfiltered.RData"
  )
)
```

Filter out: multilingual exposure, illnesses, vision and hearing problems.

```
#original sample size of 2868
#WG
wg_filtered <-
  all_wg_raw %>%
  filter(repeat_num == "1") %>%
  filterBirthweight() %>%
  filterMultilingual() %>%
  filterIllnesses() %>%
  filterVision() %>%
  filterHearing() %>%
  getCompletionInterval() %>%
  getEthnicities() %>%
  getMaternalEd() %>%
  filter(completion_time >= min_completion_time) %>%
  filter_age_wg()
```

```
## Warning: Problem with `mutate()` input `maternal_ed`.
## i Unknown levels in `f`: Not reported
## i Input `maternal_ed` is `fct_relevel(...)`.

## Warning: Unknown levels in `f`: Not reported
```

```
wg_exclusion_n <- nrow(all_wg_raw) - nrow(wg_filtered)

save(
  wg_filtered,
  file = path(
    project_root,
    "data",
    "full_dataset",
    "filtered",
    "wg_filtered.RData"
  )
)

ws_filtered <-
  all_ws_raw %>%
  filter(repeat_num == "1") %>%
  filterBirthweight() %>%
  filterMultilingual() %>%
  filterIllnesses() %>%
  filterVision() %>%
  filterHearing() %>%
  getCompletionInterval() %>%
  getEthnicities() %>%
  getMaternalEd() %>%
  filter(completion_time >= min_completion_time) %>%
  filter_age_ws()

ws_exclusion_n <- nrow(all_ws_raw) - nrow(ws_filtered)

save(
  ws_filtered,
  file = path(
    project_root,
    "data",
    "full_dataset",
    "filtered",
    "ws_filtered.RData"
  )
)

total_n <- nrow(all_ws_raw) + nrow(all_wg_raw)

filtered_n <- nrow(ws_filtered) + nrow(wg_filtered)

nrow(all_wg_raw)
```

```
## [1] 2868
```

```r
nrow(all_ws_raw)
```

```
## [1] 3594
```

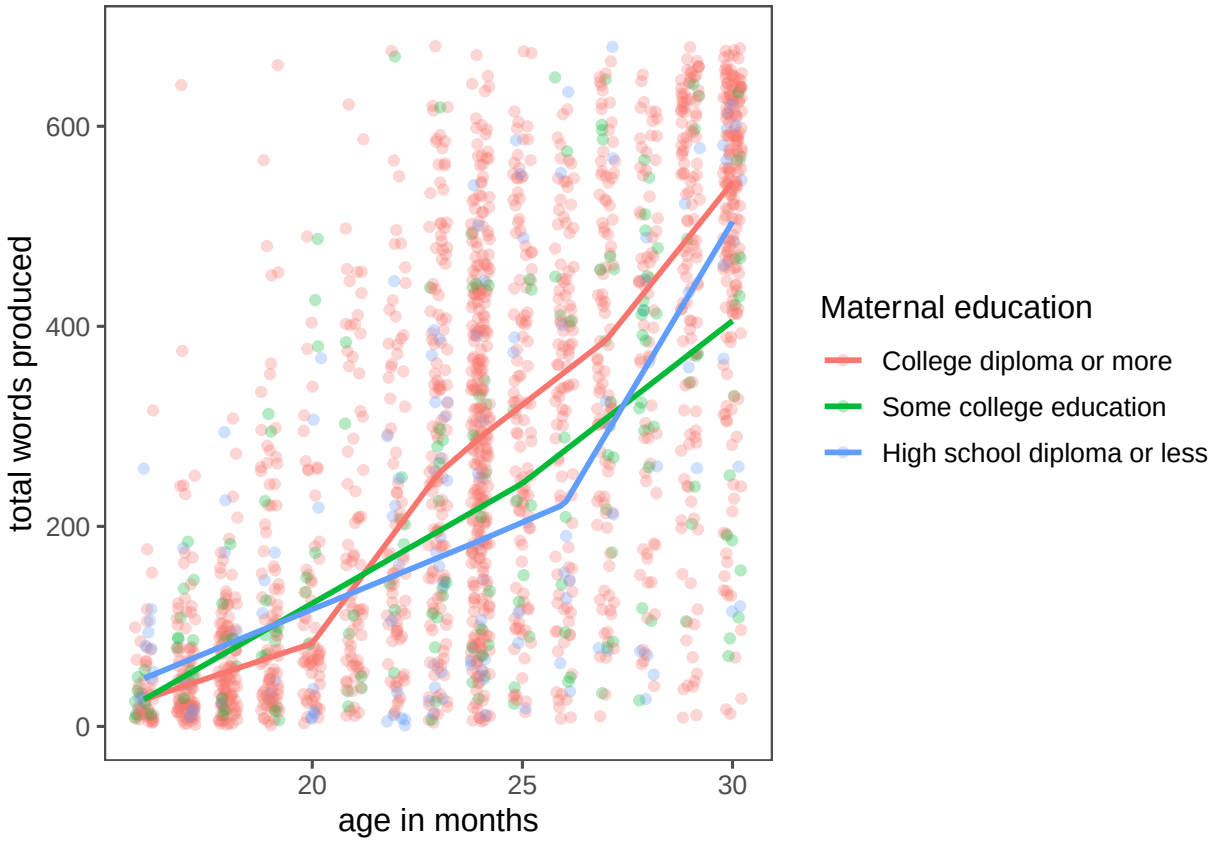
```r
#Comprehension and production measures
medians <-
  ws_filtered %>%
  mutate(
    maternal_ed = fct_recode(
      maternal_ed,
      "High school diploma or less" = "High school diploma",
      "High school diploma or less" = "Some high school or less"
    )
  ) %>%
  filter(`Total Produced` < 688 & maternal_ed != "Not reported") %>%
  group_by(maternal_ed, age) %>%
  summarize(median = median(`Total Produced`))
```

```
## `summarise()` regrouping output by 'maternal_ed' (override with `.groups` argument)
```

```r
ws_filtered %>%
  mutate(
    maternal_ed = fct_recode(
      maternal_ed,
      "High school diploma or less" = "High school diploma",
      "High school diploma or less" = "Some high school or less"
    )
  ) %>%
  filter(`Total Produced` < 688 & maternal_ed != "Not reported") %>%
  ggplot(aes(age, `Total Produced`, color = maternal_ed)) +
  ggthemes::theme_few() +
  geom_jitter(alpha = 0.3, width = 0.225) +
  coord_cartesian(ylim = c(0, 686)) +
  geom_quantile(quantiles = .5, method = "rqss", lambda = 5, size = 1) +
  #geom_line(data = medians, aes(age, median, color = maternal_ed)) +
  labs(
    x = "age in months",
    y = "total words produced",
    color = "Maternal education"
  )
```

```
## Smoothing formula not specified. Using: y ~ qss(x, lambda = 5)
```

```
## Smoothing formula not specified. Using: y ~ qss(x, lambda = 5)
## Smoothing formula not specified. Using: y ~ qss(x, lambda = 5)
```

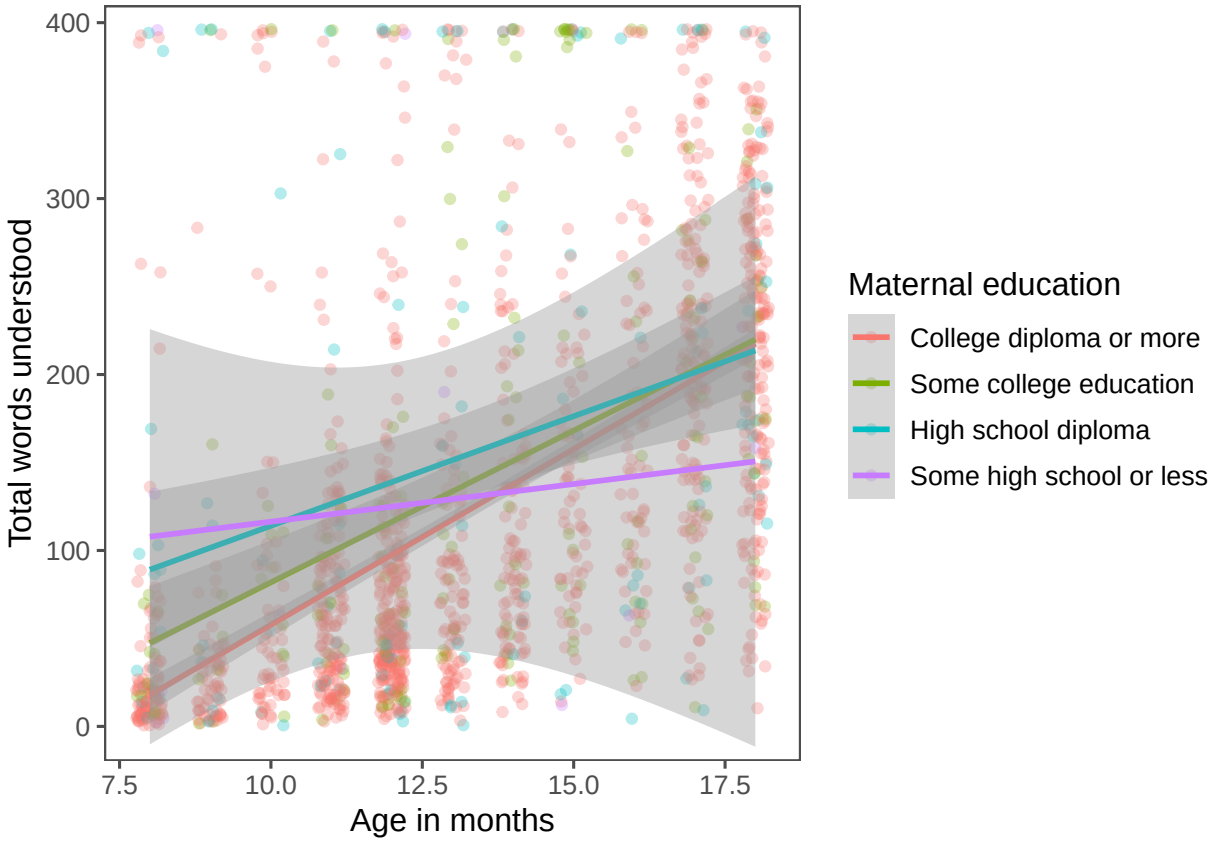



```
wg_filtered %>%
  filter(!is.na(maternal_ed)) %>%
  ggplot(aes(age, `Words Understood`, color = maternal_ed)) +
  ggthemes::theme_few() +
  geom_jitter(alpha = 0.3, width = 0.225) +
  geom_smooth(method = "lm") +
  coord_cartesian(ylim = c(0, 390)) +
  labs(
    x = "Age in months",
    y = "Total words understood",
    color = "Maternal education"
  )
```

```
## `geom_smooth()` using formula 'y ~ x'
```

```
## Warning: Removed 7 rows containing non-finite values (stat_smooth).
```

```
## Warning: Removed 7 rows containing missing values (geom_point).
```

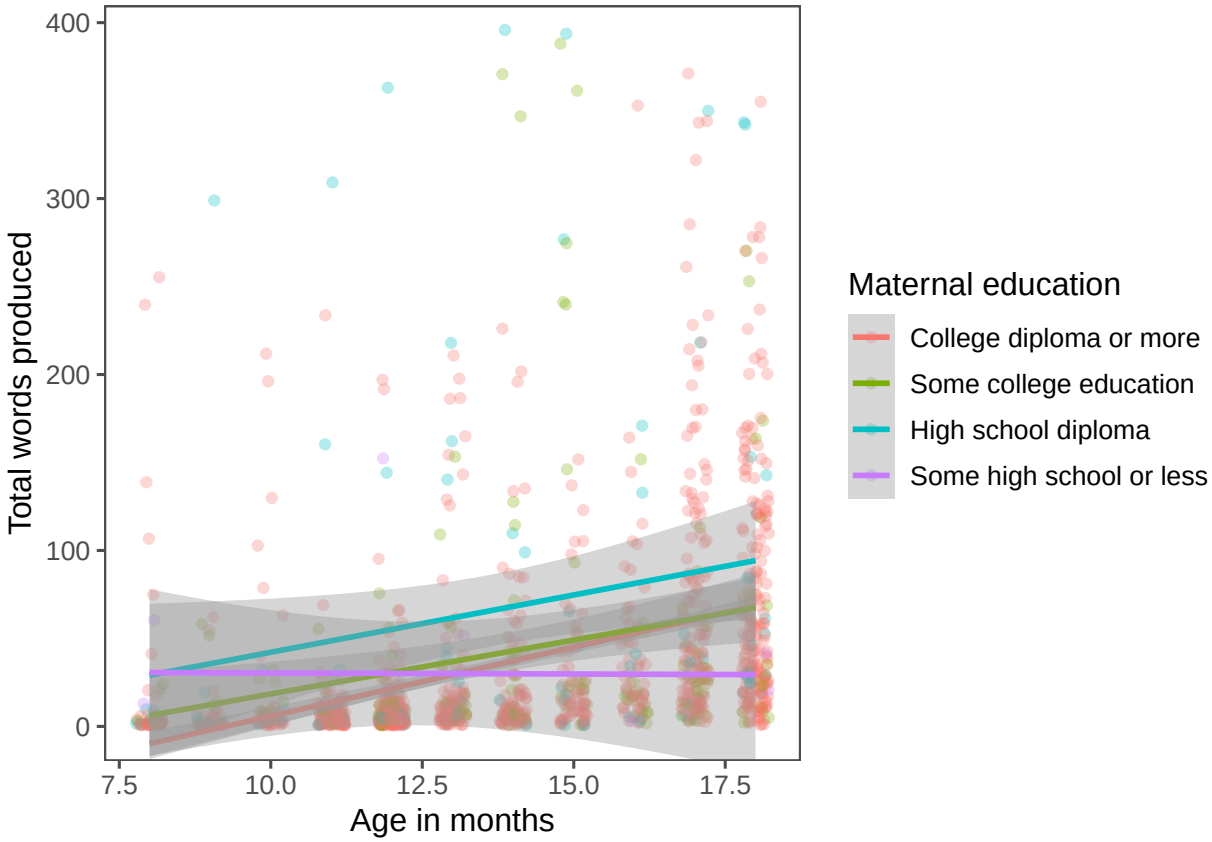



```
wg_filtered %>%
  filter(!is.na(maternal_ed)) %>%
  ggplot(aes(age, `Words Produced`, color = maternal_ed)) +
  ggthemes::theme_few() +
  geom_jitter(alpha = 0.3, width = 0.225) +
  geom_smooth(method = "lm") +
  coord_cartesian(ylim = c(0, 390)) +
  labs(
    x = "Age in months",
    y = "Total words produced",
    color = "Maternal education"
  )
```

```
## `geom_smooth()` using formula 'y ~ x'
```

```
## Warning: Removed 262 rows containing non-finite values (stat_smooth).
```

```
## Warning: Removed 262 rows containing missing values (geom_point).
```




```
wg_filtered %>%
  mutate(
    maternal_ed = fct_recode(
      maternal_ed,
      "High school diploma or less" = "High school diploma",
      "High school diploma or less" = "Some high school or less"
    )
  ) %>%
  filter(!is.na(maternal_ed)) %>%
  select(age, `Words Produced`, `Words Understood`, maternal_ed) %>%
  pivot_longer(
    cols = c("Words Produced", "Words Understood"),
    names_to = "measure",
    values_to = "words"
  ) %>%
  ggplot(aes(age, words, color = maternal_ed)) +
  facet_grid(~measure) +
  geom_jitter(alpha = 0.2, width = 0.225) +
  geom_quantile(quantiles = .5, method = "rqss", lambda = 3, size = 1) +
  coord_cartesian(ylim = c(0, 390)) +
  ggthemes::theme_few() +
  labs(
    color = "Maternal education level",
    x = "age in months",
    y = "number of words"
  ) +
```

```
  scale_x_continuous(breaks = seq(from = 8, to = 18, by = 2))
```

```
## Warning: Removed 269 rows containing non-finite values (stat_quantile).
```

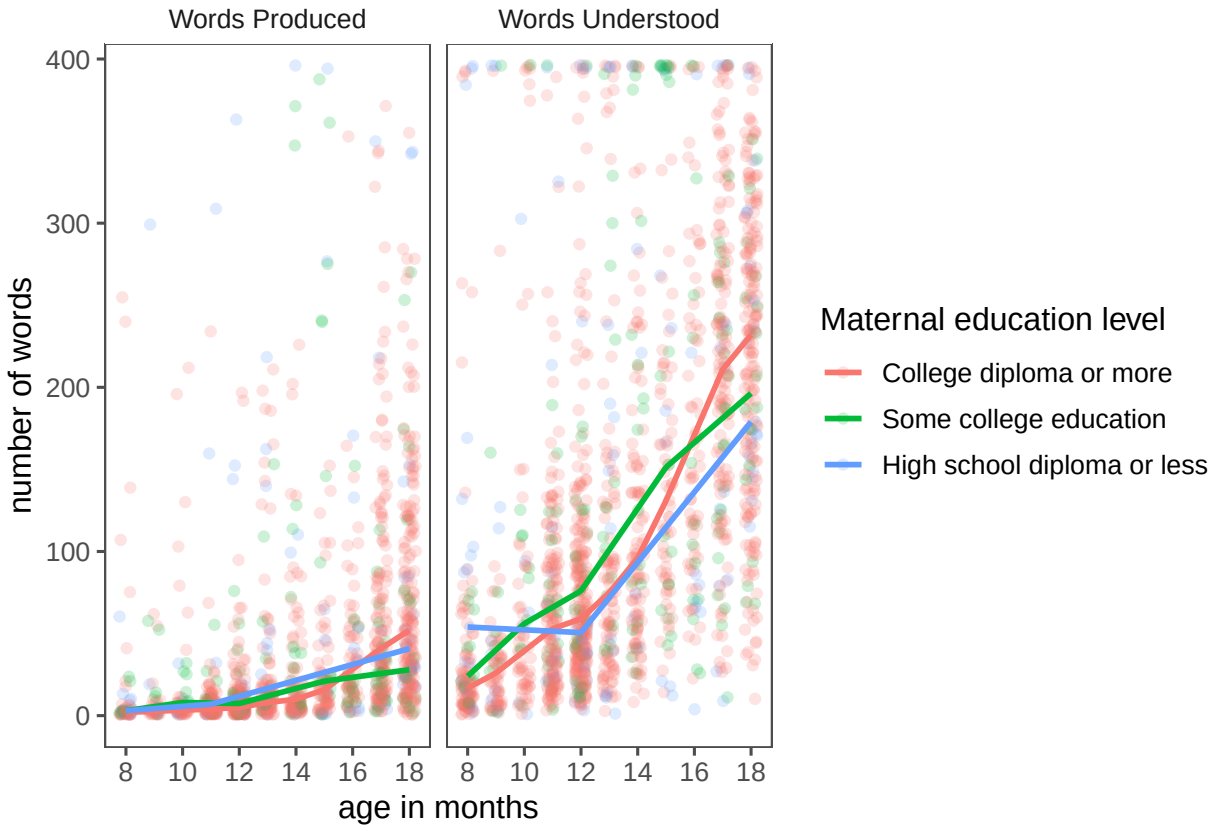
```
## Smoothing formula not specified. Using: y ~ qss(x, lambda = 3)
```

```
## Smoothing formula not specified. Using: y ~ qss(x, lambda = 3)
## Smoothing formula not specified. Using: y ~ qss(x, lambda = 3)
## Smoothing formula not specified. Using: y ~ qss(x, lambda = 3)
```

```
## Warning in rq.fit.sfn(x, y, tau = tau, rhs = rhs, control = control, ...): tiny diagonals replaced wi
```

```
## Smoothing formula not specified. Using: y ~ qss(x, lambda = 3)
## Smoothing formula not specified. Using: y ~ qss(x, lambda = 3)
```

```
## Warning: Removed 269 rows containing missing values (geom_point).
```



Inferential statistics on SES and gender

```
wg_lm_df <-
  wg_filtered %>%
  mutate(
    age_c = age - mean(age, na.rm = TRUE),
```

```
    maternal_ed_c = mother_education - mean(mother_education, na.rm = TRUE),
    maternal_ed = fct_recode(
      maternal_ed,
      "High school diploma or less" = "High school diploma",
      "High school diploma or less" = "Some high school or less"
    )
  ) %>%
  rename(produced = `Words Produced`, understood = `Words Understood`)

ses_wg_lm_prod <-
  lm_robust(formula = produced ~ age_c * maternal_ed, data = wg_lm_df)

ses_wg_lm_comp <-
  lm_robust(formula = understood ~ age_c * maternal_ed, data = wg_lm_df)

summary(ses_wg_lm_prod)
```

```
##
## Call:
## lm_robust(formula = produced ~ age_c * maternal_ed, data = wg_lm_df)
##
## Standard error type:  HC2
##
## Coefficients:
##                                          Estimate Std. Error t value
## (Intercept)                                32.297     1.4986 21.5521
## age_c                                       7.846     0.6163 12.7296
## maternal_edSome college education           6.810     5.3887  1.2638
## maternal_edHigh school diploma or less     28.793     9.3351  3.0844
## age_c:maternal_edSome college education    -1.722     1.5006 -1.1477
## age_c:maternal_edHigh school diploma or less -1.843     2.4989 -0.7377
##                                           Pr(>|t|) CI Lower CI Upper   DF
## (Intercept)                              2.050e-88   29.357   35.237 1309
## age_c                                    4.428e-35    6.637    9.055 1309
## maternal_edSome college education        2.065e-01   -3.761   17.381 1309
## maternal_edHigh school diploma or less   2.082e-03   10.480   47.107 1309
## age_c:maternal_edSome college education  2.513e-01   -4.666    1.222 1309
## age_c:maternal_edHigh school diploma or less 4.608e-01   -6.746    3.059 1309
##
## Multiple R-squared:  0.1342 ,    Adjusted R-squared:  0.1309
## F-statistic: 39.62 on 5 and 1309 DF,  p-value: < 2.2e-16
```

```
summary(ses_wg_lm_comp)
```

```
##
## Call:
## lm_robust(formula = understood ~ age_c * maternal_ed, data = wg_lm_df)
##
## Standard error type:  HC2
##
## Coefficients:
##                                          Estimate Std. Error t value
```

```
## (Intercept)                                      125.087     2.4863  50.310
## age_c                                             19.972     0.7986  25.010
## maternal_edSome college education                 14.975     8.2495   1.815
## maternal_edHigh school diploma or less            29.341    11.6341   2.522
## age_c:maternal_edSome college education           -2.720     2.3393  -1.163
## age_c:maternal_edHigh school diploma or less      -8.351     3.2621  -2.560
##                                                   Pr(>|t|) CI Lower CI Upper   DF
## (Intercept)                                      0.000e+00  120.210  129.964 1564
## age_c                                            2.072e-116   18.406   21.539 1564
## maternal_edSome college education                6.968e-02   -1.206   31.156 1564
## maternal_edHigh school diploma or less           1.177e-02    6.521   52.161 1564
## age_c:maternal_edSome college education          2.451e-01   -7.309    1.868 1564
## age_c:maternal_edHigh school diploma or less     1.056e-02  -14.750   -1.953 1564
##
## Multiple R-squared:  0.2869 ,    Adjusted R-squared:  0.2846
## F-statistic: 142.3 on 5 and 1564 DF,  p-value: < 2.2e-16
```

```
ws_lm_df <-
  ws_filtered %>%
  filter(`Total Produced` < 688 & maternal_ed != "Not reported") %>%
  mutate(
    age_c = age - mean(age, na.rm = TRUE),
    maternal_ed_c = mother_education - mean(mother_education, na.rm = TRUE),
    maternal_ed = fct_recode(
      maternal_ed,
      "High school diploma or less" = "High school diploma",
      "High school diploma or less" = "Some high school or less"
    )
  ) %>%
  rename(produced = `Total Produced`) %>%
  filter(maternal_ed_c > -10)

ses_ws_lm <-
  lm(formula = produced ~ age_c * maternal_ed, data = ws_lm_df)

summary(ses_ws_lm)
```

```
##
## Call:
## lm(formula = produced ~ age_c * maternal_ed, data = ws_lm_df)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -472.83  -96.81   -8.98  108.23  581.65
##
## Coefficients:
##                                                 Estimate Std. Error t value
## (Intercept)                                     282.6136     3.8778  72.880
## age_c                                            32.8067     0.9379  34.978
## maternal_edSome college education               -44.3608    12.0816  -3.672
## maternal_edHigh school diploma or less          -53.2844    13.9654  -3.815
## age_c:maternal_edSome college education          -8.7606     2.8164  -3.111
## age_c:maternal_edHigh school diploma or less     -6.7600     3.3213  -2.035
##                                                 Pr(>|t|)
```

```
## (Intercept)                                      < 2e-16 ***
## age_c                                            < 2e-16 ***
## maternal_edSome college education               0.000247 ***
## maternal_edHigh school diploma or less          0.000140 ***
## age_c:maternal_edSome college education         0.001895 **
## age_c:maternal_edHigh school diploma or less 0.041954 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 155.1 on 1914 degrees of freedom
## Multiple R-squared:  0.4245, Adjusted R-squared:  0.423
## F-statistic: 282.4 on 5 and 1914 DF,  p-value: < 2.2e-16
```

```
gender_ws_lm <-
  lm(formula = produced ~ age_c * sex, data = ws_lm_df)

summary(gender_ws_lm)
```

```
##
## Call:
## lm(formula = produced ~ age_c * sex, data = ws_lm_df)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -432.38  -97.05   -4.50  110.88  567.99
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)     297.781      5.126  58.090  < 2e-16 ***
## age_c            33.028      1.221  27.059  < 2e-16 ***
## sexMale         -43.184      7.098  -6.084 1.41e-09 ***
## sexOther        -43.592    107.000  -0.407    0.684
## age_c:sexMale    -2.525      1.707  -1.479    0.139
## age_c:sexOther   -1.394     22.674  -0.061    0.951
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 155 on 1914 degrees of freedom
## Multiple R-squared:  0.4253, Adjusted R-squared:  0.4238
## F-statistic: 283.3 on 5 and 1914 DF,  p-value: < 2.2e-16
```

Gender analyses

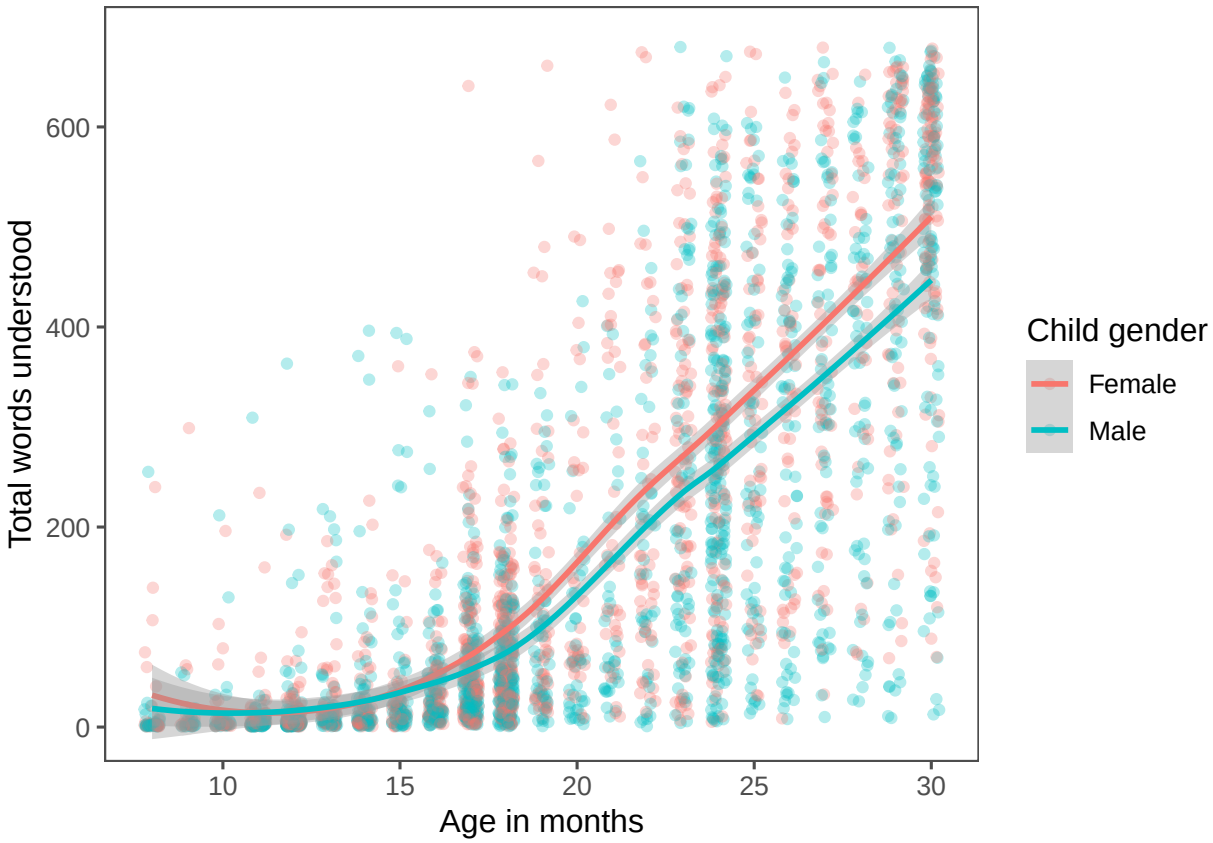
```
wg_filtered_gender <-
  wg_filtered %>%
  select(age, production = `Words Produced`, sex)

ws_filtered_gender <-
  ws_filtered %>%
  select(age, production = `Total Produced`, sex)

#filter out kids without a binary gender listed
all_d_gender <-
```

```
  bind_rows(ws_filtered_gender, wg_filtered_gender) %>%
  filter(sex != "Other")

all_gender_n <- nrow(all_d_gender)

all_d_gender %>%
  ggplot(aes(age, production, color = sex)) +
  ggthemes::theme_few() +
  geom_jitter(alpha = 0.3, width = 0.225) +
  geom_smooth(method = "loess") +
  coord_cartesian(ylim = c(0, 686)) +
  labs(
    x = "Age in months",
    y = "Total words understood",
    color = "Child gender"
  )
```

```
## `geom_smooth()` using formula 'y ~ x'
```

```
## Warning: Removed 272 rows containing non-finite values (stat_smooth).
```

```
## Warning: Removed 272 rows containing missing values (geom_point).
```



```r
#Counting hispanic and latino heritage
wg_filtered %>%
  mutate(hispanic = !is.na(child_hispanic_latino) & child_hispanic_latino == TRUE) %>%
  count(hispanic) %>%
  mutate(prop = n / sum(n))
```

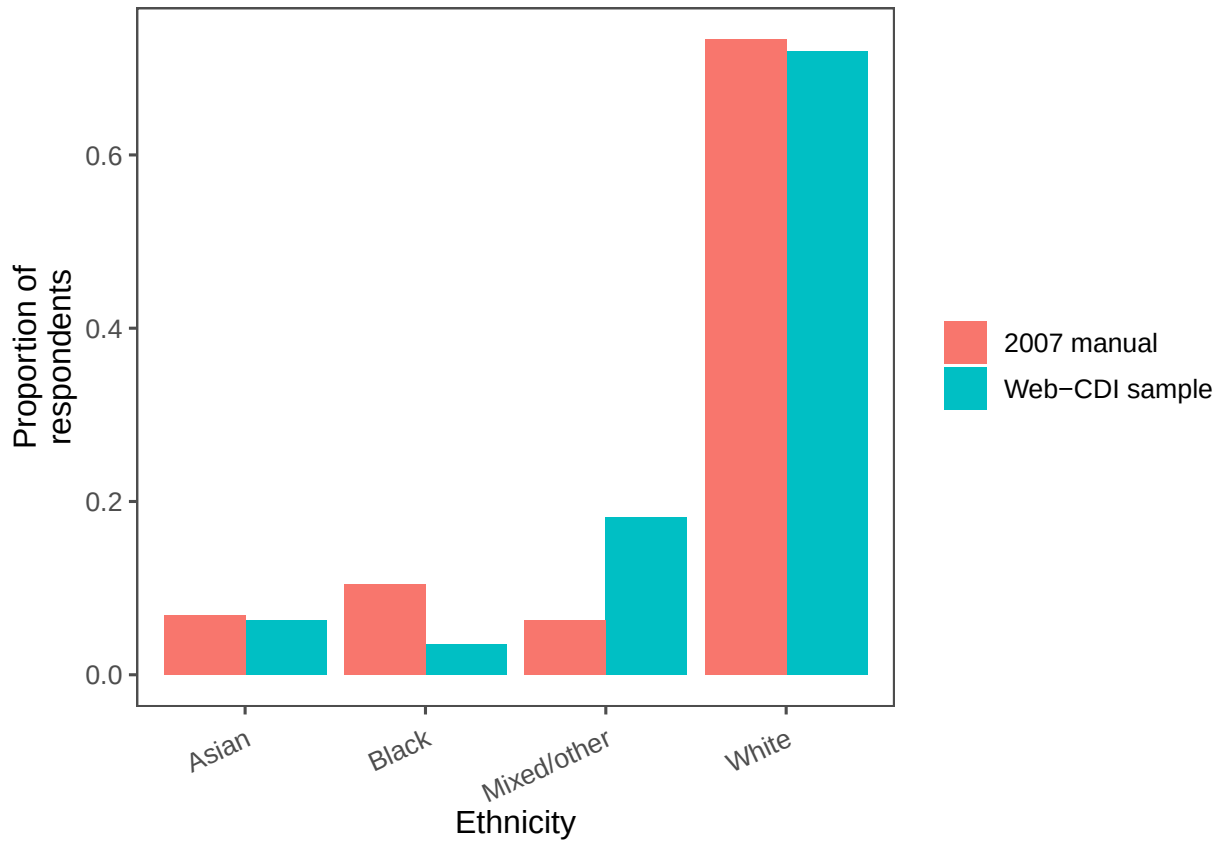
```
## # A tibble: 2 x 3
##   hispanic     n   prop
##   <lgl>    <int>  <dbl>
## 1 FALSE     1475 0.935
## 2 TRUE       102 0.0647
```

```r
ws_filtered %>%
  mutate(hispanic = !is.na(child_hispanic_latino) & child_hispanic_latino == TRUE) %>%
  count(hispanic)%>%
  mutate(prop = n / sum(n))
```

```
## # A tibble: 2 x 3
##   hispanic     n   prop
##   <lgl>    <int>  <dbl>
## 1 FALSE     1853 0.949
## 2 TRUE        99 0.0507
```

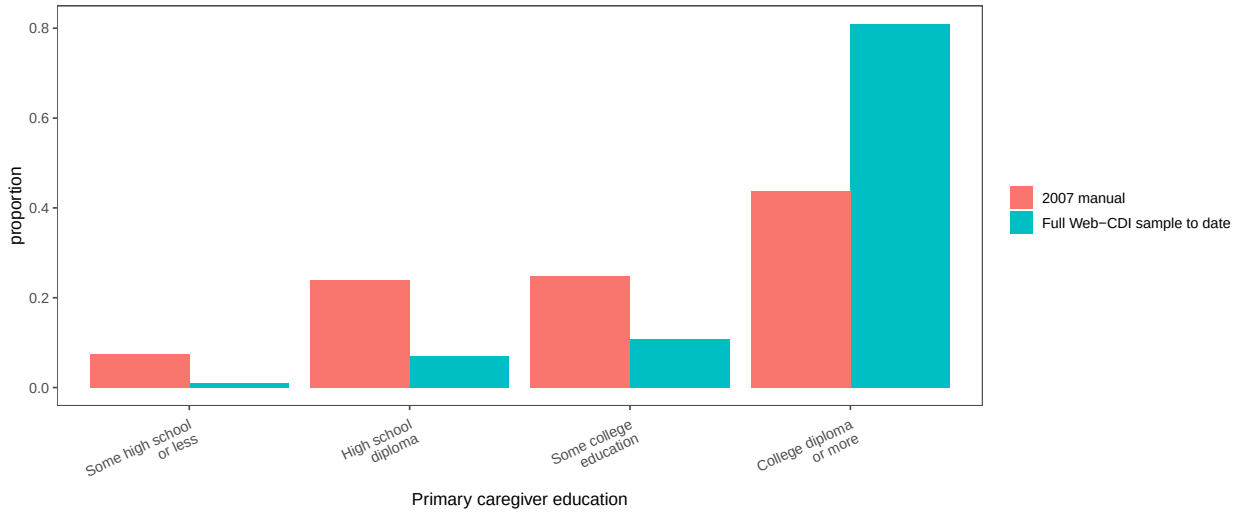
```r
#Demographic analyses on the entire sample


demographics_df <-
  bind_rows(
    wg_filtered %>%
      select(
        study_name,
        subject_id,
        age,
        ethnicity,
        maternal_ed,
        words_produced = `Words Produced`
      ),
    ws_filtered %>%
      select(
        study_name,
        subject_id,
        age,
        ethnicity,
        maternal_ed,
        words_produced = `Total Produced`
      )
  )

ethnicity_plot_df <-
  demographics_df %>%
  getEthnicitySummary() %>%
  filter(!is.na(ethnicity)) %>%
```

```
  filter(ethnicity != "No ethnicity reported") %>%
  mutate(`Web-CDI sample` = prop.table(n)) %>%
  left_join(old_ethnicity_numbers, by = "ethnicity") %>%
  select(-n) %>%
  pivot_longer(
    cols = c(`Web-CDI sample`, `2007 manual`),
    names_to = "study",
    values_to = "proportion"
  )

ethnicity_plot <-
  ethnicity_plot_df %>%
  ggplot(aes(ethnicity, proportion, fill = study)) +
  geom_col(position = "dodge") +
  labs(
    y = "Proportion of\nrespondents"
  ) +
  theme_few() +
  theme(
    legend.title = element_blank(),
    axis.text.x = element_text(
       angle = 25,
       vjust = 0.9,
       hjust = 1
     )
  ) +
  labs(x = "Ethnicity")

# +
#   theme(
#     legend.title = element_blank(),
#     axis.text = element_text(size = 14),
#     axis.title = element_text(size = 13),
#     legend.text = element_text(size = 13),
#     axis.title.x = element_blank(),
#     plot.title = element_text(size = 15),
#     plot.caption = element_text(hjust = 0)
#   )

ethnicity_plot
```



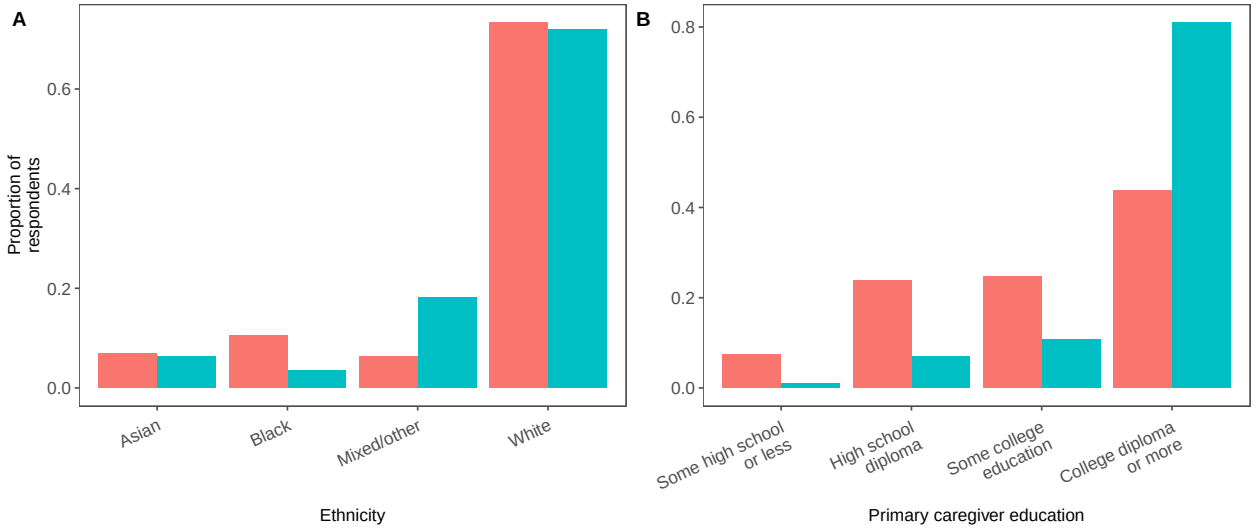

```r
#Maternal ed analysis on the full sample

maternal_ed_plot_df <-
  demographics_df %>%
  count(maternal_ed) %>%
  mutate(`Full Web-CDI sample to date` = prop.table(n)) %>%
  left_join(old_momed_numbers, by = "maternal_ed") %>%
  select(-n) %>%
  pivot_longer(
    cols = c(`Full Web-CDI sample to date`, `2007 manual`),
    names_to = "study",
    values_to = "proportion"
  ) %>%
  mutate(
    maternal_ed = fct_relevel(
      maternal_ed,
      "Some high school or less",
      "High school diploma",
      "Some college education",
      "College diploma or more"
    )
  ) %>%
  filter(!is.na(maternal_ed))

x_axis_labs <- c(
  "Some high school\n or less",
```

```
  "High school\ndiploma",
  "Some college\neducation",
  "College diploma\nor more"
)

maternal_ed_plot <-
  maternal_ed_plot_df %>%
  filter(maternal_ed != "Not reported") %>%
  ggplot(aes(maternal_ed, proportion, fill = study)) +
  geom_col(position = "dodge") +
  labs(x = "Primary caregiver education") +
  theme_few() +
  theme(
    legend.title = element_blank(),
    axis.text.x = element_text(angle = 25, vjust = 0.9, hjust = 1)
  ) +
  scale_x_discrete(labels = x_axis_labs)

maternal_ed_plot
```

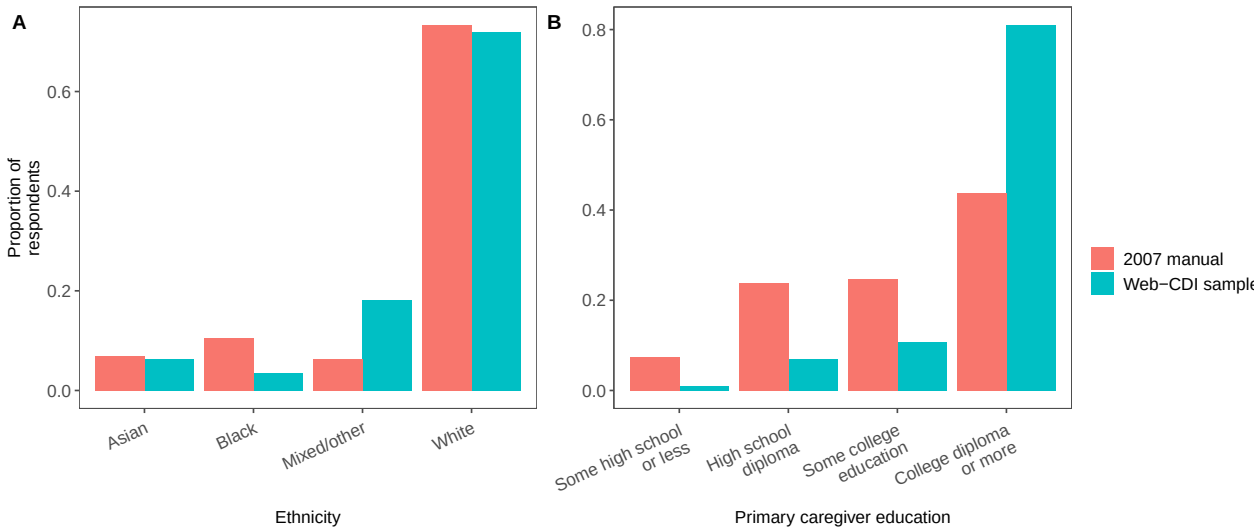



```
#this table can be printed out
maternal_ed_table <-
  maternal_ed_plot_df %>%
  filter(maternal_ed != "Not reported") %>%
  pivot_wider(names_from = "study", values_from = "proportion") %>%
  mutate(
    `Current study proportions` = round(`Full Web-CDI sample to date`, digits = 4)
  ) %>%
  select(-`Full Web-CDI sample to date`)

prow <- cowplot::plot_grid(
  ethnicity_plot +
    theme(
      legend.position = "none",
      plot.margin = (margin(r = 2, l = 0)),
      axis.text = element_text(size = 12)
```

```
    ),
  maternal_ed_plot +
    ylab(NULL) +
    theme(
      legend.position = "none",
      plot.margin = (margin(r = 2, l = 2)),
      axis.text = element_text(size = 12)
    ),
  align = "vh",
  labels = c("A", "B")
)
prow
```




```
legend <-
  get_legend(
    ethnicity_plot +
      # guides(color = guide_legend(nrow = 1)) +
      # theme(legend.position = "bottom")
      theme(
        legend.box.margin = margin(0, 0, 0, 15),
        legend.text = element_text(size = 12)
      )
  )

plot_grid(prow, legend, rel_widths = c(3, .5))
```



‘

```
#More fine grained analyses of exclusions. Copied and pasted from all_norming_analysis.Rmd.

n_total_wg <- nrow(all_wg_raw)
n_total_ws <- nrow(all_ws_raw)

excl_col_names <-
  c(
    "Exclusion",
    "WG exclusions",
    "% of full WG sample excluded",
    "WS exclusions",
    "% of full WS sample excluded"
  )


#First take away kids who have done the survey more than once.
wg_minus_repeats <-
  all_wg_raw %>%
  getCompletionInterval() %>%
  filter(repeat_num == "1")

wg_repeats_n <- n_total_wg - nrow(wg_minus_repeats)

ws_minus_repeats <-
  all_ws_raw %>%
  getCompletionInterval() %>%
  filter(repeat_num == "1")

ws_repeats_n <- n_total_ws - nrow(ws_minus_repeats)

repeat_admins <-
  c(
    "Not first administration",
    wg_repeats_n,
    percent(wg_repeats_n / n_total_wg),
```

```
    ws_repeats_n,
    percent(ws_repeats_n / n_total_ws)
  )

names(repeat_admins) <- excl_col_names

#Next take away kids born pre-term or with low birthweight.

wg_minus_premie <-
  wg_minus_repeats %>%
  filterBirthweight()

wg_premie_n <- nrow(wg_minus_repeats) - nrow(wg_minus_premie)

ws_minus_premie <-
  ws_minus_repeats %>%
  filterBirthweight()

ws_premie_n <- nrow(ws_minus_repeats) - nrow(ws_minus_premie)

premies <-
  c(
    "Premature or low birthweight",
    wg_premie_n,
    percent(wg_premie_n / n_total_wg),
    ws_premie_n,
    percent(ws_premie_n / n_total_ws)
  )

names(premies) <- excl_col_names

#Next take away kids with multilingual exposure

wg_minus_multiling <-
  wg_minus_premie %>%
  filterMultilingual()

wg_multiling_n <- nrow(wg_minus_premie) - nrow(wg_minus_multiling)

ws_minus_multiling <-
  ws_minus_premie %>%
  filterMultilingual()

ws_multiling_n <- nrow(ws_minus_premie) - nrow(ws_minus_multiling)

multiling <-
  c(
    "Multilingual exposure",
    wg_multiling_n,
    percent(wg_multiling_n / n_total_wg),
    ws_multiling_n,
    percent(ws_multiling_n / n_total_ws)
  )
```

```
names(multiling) <- excl_col_names

#Next exclude kids with problems of illness, vision, or hearing
wg_minus_health <-
  wg_minus_multiling %>%
  filterIllnesses() %>%
  filterVision() %>%
  filterHearing()

wg_health_n <- nrow(wg_minus_multiling) - nrow(wg_minus_health)

ws_minus_health <-
  ws_minus_multiling %>%
  filterIllnesses() %>%
  filterVision() %>%
  filterHearing()

ws_health_n <- nrow(ws_minus_multiling) - nrow(ws_minus_health)

health <-
  c(
    "Illnesses/Vision/Hearing",
    wg_health_n,
    percent(wg_health_n / n_total_wg),
    ws_health_n,
    percent(ws_health_n / n_total_ws)
  )

names(health) <- excl_col_names

#Now filter out kids who are the wrong age
wg_minus_age <-
  wg_minus_health %>%
  filter_age_wg()

wg_age_n <- nrow(wg_minus_health) - nrow(wg_minus_age)

ws_minus_age <-
  ws_minus_health %>%
  filter_age_ws()

ws_age_n <- nrow(ws_minus_health) - nrow(ws_minus_age)

age <-
  c(
    "Out of age range",
    wg_age_n,
    percent(wg_age_n / n_total_wg),
    ws_age_n,
    percent(ws_age_n / n_total_ws)
  )

names(age) <- excl_col_names
```

```r
#Now we need to get rid of people who did the survey too fast

wg_minus_fakes <-
  wg_minus_age %>%
  filter(completion_time >= min_completion_time)

wg_fake_n <- nrow(wg_minus_age) - nrow(wg_minus_fakes)

ws_minus_fakes <-
  ws_minus_age %>%
  filter(completion_time >= min_completion_time)

ws_fake_n <- nrow(ws_minus_age) - nrow(ws_minus_fakes)

fakes <-
  c(
    "Completed survey too quickly",
    wg_fake_n,
    percent(wg_fake_n / n_total_wg),
    ws_fake_n,
    percent(ws_fake_n / n_total_ws)
  )

names(fakes) <- excl_col_names

#calculate total amount of WG exclusions
total_wg_exclusions <-
  wg_repeats_n +
  wg_premie_n +
  wg_multiling_n +
  wg_health_n +
  wg_age_n +
  wg_fake_n

#calculate total amount of WS exclusions
total_ws_exclusions <-
  ws_repeats_n +
  ws_premie_n +
  ws_multiling_n +
  ws_health_n +
  ws_age_n +
  ws_fake_n

#make a row in the table for this
totals <-
  c(
    "Total exclusions",
    total_wg_exclusions,
    percent(total_wg_exclusions / n_total_wg),
    total_ws_exclusions,
    percent(total_ws_exclusions / n_total_ws)
  )
```

```
names(totals) <- excl_col_names

#now make the table
exclusion_tbl <-
  bind_rows(repeat_admins, premies, multiling, health, age, fakes, totals)

knitr::kable(exclusion_tbl)
```

Exclusion	WG exclusions	% of full WG sample excluded	WS exclusions	% of full WS sample excluded
Not first administration	163	6%	444	12%
Premature or low birthweight	37	1%	67	2%
Multilingual exposure	449	16%	492	14%
Illnesses/Vision/Hearing	191	7%	203	6%
Out of age range	88	3%	200	6%
Completed survey too quickly	363	13%	236	7%
Total exclusions	1291	45%	1642	46%

```
write_csv(
  exclusion_tbl,
  file = path(
    project_root,
    "data",
    "exclusion_tables",
    "full_sample_norming_exclusions",
    ext = "csv"
  )
)
```

Options table

```
options_table <-
  read_csv(
    path(
      project_root,
      "paper",
      "options_table",
      ext = "csv"
    )
  ) %>%
  filter(!is.na(`Study setting`)) %>%
  knitr::kable()
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   `Study setting` = col_character(),
##   `Default value ` = col_character(),
```

```
##   Notes = col_character()
## )
```

```
options_table
```

Study setting	Default value	Notes
Study name	none	NA
Instrument	none	NA
Number of days before study expiration	14	Must be between 1 and 28 days.
Measurement units for birth weight	Pounds and ounces	Weight can also be measured in kilograms (kg).
Minimum time (minutes) a parent must take to complete the study	6	NA
Waiver of documentation	blank	Can be filled in by researchers to include a Waiver of Documentation for the participant to approve before proceeding to the experiment.
Pre-fill data for longitudinal participants?	"No, do not populate any part of the form"	Researchers can choose to pre-fill the background information and the vocabulary checklist.
Would you like to pay subjects in the form of Amazon gift cards?	No	If checked, researchers can enter gift codes to distribute to participants once they have completed the survey.
Do you plan on collecting only anonymous data in this study? (e.g., posting ads on social media, mass emails, etc)	No	If checked, researchers can set a limit for the maximum number of participants, as well as select an option that asks participants to verify that the information entered is accurate.
Would you like to show participants graphs of their data after completion?	Yes	NA
Would you like participants to be able to share their Web-CDI results via Facebook?	No	NA