Statistical Analysis of participation surveys

for

"Omaha Girls Rock"

Group 1

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ISQA 4150 / 8156 – Course Project Spring 2021

INTRODUCTION

Omaha Girls Rock is an organization whose goal is to create an opportunity for young girls' cultural expression and equitable access to the arts. The organization's main driving force is to give girls the confidence to use their voice through music education and performance. The programs in Omaha Girls' Rock use music education like songwriting, technical skill building, forming a band, and historical impact of women in music to achieve their goal. In Omaha Girls Rock, music education is closely tied with activism and female empowerment. Omaha Girls Rock values diversity of age, race, economic status, gender, size, physical and developmental ability, and musical interests.

There are various programs that are run by Omaha Girls' Rock (OGR) like Summer Camps, OGR academy, OGR community etc. Among them Summer camps are very important for children to develop important social, emotional, and cognitive skills. Best of all, children create memories that last a lifetime at camp .Omaha Girls Rock has the same value and belief system and with their exciting programs they tried to create a long-lasting impression in their participant's heart. The Summer Camps are organized for girls with ages between 4-16. It is a two-week program and almost 200 youths attend it every year .It includes various activities like instrument instruction, workshops, songwriting and band practice, live performances by visiting artists, and a final showcase concert. For each summer camp there is a pre and post survey using a range of questions to measure the impact of their program on participants. In this project, we are trying to find out how Omaha Girls Rock can improve their program by providing statistical data analysis for a set of research questions. Specifically, OGR conducts pre- and post-participation surveys using a range of questions to measure the impact of their program on participants. From the data, we can analyze the relative factors of the change of students' answers. Furthermore, we tried to go deep and find some hidden information from the data. In our team, we are mainly focused on finding whether age and race/ethnicity of participants do play an important role in affecting the participants to change their ratings after the program.

DATA DESCRIPTION

There are two sets of data provided by Omaha Girls Rock, one is for the year 2018, the other one is for 2019. Both datasets include Pretest and Posttest survey of younger group (age 10-12) and older group (age 13-16). There are totally 194 data in 2018, and 166 data in 2019. Both excel files do not have many observations. We can tell that the structure of the two excel files are the same. Each has the answer(rating) of the questionnaire's questions, and the additional basic information of the student: race/ethnicity, age, years at camp, and zip code.

Below are the variables from each dataset.

Client ID – Name of the participant (Datatype: Categorical)

Age – Age of the participant at the time of attending the camp (Datatype: Numerical)

Years – Number of years of participation in the summer camp (Datatype: Numerical)

Race/Ethnicity – Race of the participants (Datatype: Categorical)

Zip code – The address of the participants (Datatype: Numerical)

Question 1 – "1.Start a conversation with a boy or girl you don't know very well- of the survey" (Datatype: Numerical)

Question 2 – "2. Express your opinion to a group of kids discussing a subject of interest to you" (Datatype: Numerical)

Question 3 – "3.Join a group of kids in the school cafeteria for lunch" (Datatype: Numerical)

Question 4 – "4. Work on a project with a student you don't know very well" (Datatype: Numerical)

Question 5 – "5. Help make a new student feel comfortable with your group of friends" (Datatype: Numerical)

Question 6 – 6. Share with a group of kids an interesting experience you once had (Datatype: Numerical)

Question 7 – "7. Put yourself in a new and different social situation"(Datatype: Numerical)

Question 8 – "8. Volunteer to help organize a school dance"(Datatype: Numerical)

Question 9 – "9. Ask a group of kids who are planning to go to a movie if you can join them" (Datatype: Numerical)

Question 10 – "10. Stand up for your rights when someone accuses you of doing something you didn't do"(Datatype: Numerical)

Question 11 – "11. Get invited to a party that's being given by one of the most popular kids in the class" (Datatype: Numerical)

Question 12 – "12. Keep up your side of the conversation" (Datatype: Numerical)

Question 13 – "13. Be involved in group activities" (Datatype: Numerical)

Question 14 – "14. Find someone to spend recess with" (Datatype: Numerical)

DATA PROCESSING

We split the dataset into eight parts, which are:

1. 2018 Pre-test Older Group

2. 2018 Post-test Older Group

3. 2018 Pre-test Younger Group

4. 2018 Post-test Younger Group

5. 2019 Pre-test Older Group

6. 2019 Post-test Older Group

7. 2019 Pre-test Younger Group

8. 2019 Post-test Younger Group

Client ID	Age	Years at Camp	Race/Ethnicity	Zip Code	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
1	14	2	Black/Afri	68111	2	4	5	5	6	4	3	7	6	7	6	7	7	6
2	16	1	Other	68134	4	5	7	4	7	5	4	7	7	7	7	5	4	4
3	13	1	Caucasian	68134	3	6	4	6	6	6	3	6	5	7	7	7	7	7
4	14	3	Caucasian	68106	6	7	5	7	5	7	7	7	5	7	4	6	7	7
5	15	4	Black/Afri	68111	7	7	6	5	7	7	5	6	6	7	5	6	7	7
6	13	3	Caucasian	68132	4	4	3	3	6	4	4	5	3	5	4	4	6	6
7	14	4	Caucasian	68132	5	6	4	5	5	6	5	7	4	6	3	5	6	6
8	14	6	Caucasian	68105	6	7	4	4	7	7	6	7	6	6	6	7	7	7
9	13	1	Caucasian	68131	7	6	4	4	7	7	5	7	5	7	5	7	7	7
10	14	8	Caucasian	68106	5	6	5	7	6	6	4	6	5	7	5	6	6	6
11	14	7	Black/Afri	68005	5	7	6	5	7	6	2	6	5	3	7	5	3	6
12	15	3	Caucasian	68104	3	5	3	3	5	2	2	2	1	4	2	3	3	3
13	15	3	Caucasian	68114	6	5	6	7	7	6	6	6	5	6	6	7	7	7
14	13	6	Black/Afri	68112	7	7	5	7	7	7	7	7	6	7	6	7	7	7
15	14	6	Caucasian	68105	6	7	5	5	5	6	6	6	6	7	6	7	7	7
16	13	5	Caucasian	68105	6	7	7	6	7	6	5	7	4	7	7	7	6	7
17	14	2	Caucasian	68137	4	4	4	4	4	4	4	3	2	7	4	4	4	4
18	14	3	Asian / Ca	68124	4	3	4	4	5	5	4	4	3	5	4	5	5	5
19	13	4	Caucasian	68105	5	4	6	5	5	6	4	6	6	3	5	6	5	5
20	13	4	Caucasian	68153	4	5	4	6	6	6	6	4	4	6	5	5	5	5
21	13	2	Black/Afri	68005	4	4	6	7	7	4	4	7	2	7	5	6	7	7
22	14	6	Caucasian	68105	7	7	7	7	7	7	6	6	5	6	6	7	7	7
23	15	3	Caucasian	68025	6	6		5	6	5	4	5	6	7	6	5	5	6
24	13	1	Caucasian	68007	3	2	7	3	4	4	3	5	3	7	2	5	6	6
25	15	4	Caucasian	68510	6	6	4	4	5	5	4	7	4	7	5	5	4	5
26	14	1	Hispanic/L	51551	3	3	3	3	6	3	4	4	2	5	4	3	3	4
27	14	8	Caucasian	68104	7	6	6	5	6	6	7	5	6	7	7	7	7	7
28	13	5	Caucasian	68164	3	3	4	5	6	5	2	6	2	6	4	7	5	6
29	13	1	Caucasian	68104	4	4	6	4	6	6	5	6	2	6	4	4	5	7
30	15	2	Caucasian	68341	3	3	4	3	5	4	3	4	2	5	3	4	4	3
31	16	8	Caucasian	68105	6	6	7	7	6	5	6	5	4	7	7	7	7	7
32	14	2	Black/Afri	68111	7	5	4	6	5	7	4	6	5	7	1	6	4	7
33	16	7	Caucasian	68046	6	6	4	6	6	6	5	5	2	7	5	7	7	7
34	13	1	Black/Afri	68111	1	4	4	3	6	3	2	4	3	7	4	4	3	2
35	13	1	Caucasian	68130	5	4	5	3	6	5	4	5	1	6	5	6	4	5
36	16	8	Caucasian	68502	5	5	4	3	6	5	4	3	4	5	2	4	3	4
37	16	6	Caucasian	68901	2	2	2	3	4	3	2	4	2	5	3	4	4	4

Worksheet tab: 2019_PREtest-Older Group

The example above is one of the datasets, 2019 Pre-test Older group. We are splitting into eight parts so we can compare the numbers among each dataset to study the differences between younger and older groups, as well as the difference between data in 2018 and data in 2019. The attributes on each dataset are the same with the provided dataset, which include ClientID, Age, Years at Camp, Race/Ethnicity, Zip Code, and Q1 to Q14 which are the ratings for each question.

- We retain most of the attributes as original form, except for 'Race/Ethnicity'. We combined all races groups with two or more races into 'Biracial/Multiple races'. For example, we would change 'Black/African / Caucasian /Hispanic, Latinx' into 'Biracial/Multiple races'. The reason for doing so is to reduce the levels of categorical variables, which can combine the categories that have very small numbers of observations and likely be useless to make them useful to the analysis.
- We found two observations of age 12 participants in the 2018 older group. Since the age of older group participants should be 13-16, we considered the two participants as anomaly data and decided to remove them.
- We observe missing data in some attributes. We decided to retain all observations because we do not have many observations in datasets, and we can use part of the observation for our analysis. We will use code na.rm=TRUE in R code to remove missing data if needed.

DESCRIPTIVE STATISTICS

1. Means for the pre- and post- test groups

	Pre-test				Post-test			
	Older Group		Younger Group		Older Group		Younger Group	
	2018	2019	2018	2019	2018	2019	2018	2019
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
Q1	5	4.78	5.49	4.51	4.75	5.62	5.48	5.35
Q2	5.57	5.08	6.06	4.89	5	5.68	5.9	5.7
Q3	4.63	4.83	5.31	4.48	4.88	5.32	5.85	4.91
Q4	5.29	4.84	5.71	4.8	5.1	5.86	5.63	5.61
Q5	5.78	5.86	6.12	5.84	6	6.19	6.17	6.17
Q6	5.31	5.3	6.04	5.11	5.27	5.84	5.81	5.7
Q7	4.76	4.35	5.16	4	4.83	5.19	5.02	4.7
Q8	4.8	5.49	5.27	4.96	5	5.49	5.67	5.58
Q9	4.39	4.03	4.49	3.74	4.33	4.46	4.85	4.13
Q10	6.04	6.16	6.33	6.02	6.15	6	6.48	6.25
Q11	4.78	4.78	5.1	4.28	4.42	5.03	5.21	5.04
Q12	5.47	5.57	5.92	5	5.33	5.84	5.73	5.36
Q13	5.84	5.43	5.98	5.5	6.15	6.22	6.02	5.87
Q14	5.45	5.68	5.71	5.28	5.79	5.95	6.13	5.33

We created a table to record the means for the pre- and post- camp surveys for each group to perform numerical analysis of the data, and we highlighted the highest mean for each row. We observed that most of the highest mean records are from post-test groups. It seems like most of

the highest mean for the older group recorded in the year 2019 post camp survey whereas for the younger group 2018 year seems to be the year with more recorded highest means in Post camp survey. Also, we generally see that there is an increase of mean from pre-test group to post-test group.

2. Means for the pre- and post- test groups based on races

2018 Pre-test Older Group					
Asian	Caucasian	Black/African	Hispanic/Latinx	Native American	Biracial/Multiple races
Mean	Mean	Mean	Mean	Mean	Mean
Q1 3	4.97	5.2	4	3	6
Q2 5	5.61	6	5	4	5.4
Q3 5	4.53	4.5	7	2	5.4
Q4 5	5.39	4.8	6	4	5.2
Q5 4	5.86	5.6	5	5	6
Q6 5	5.33	5.2	4	5	5.6
Q7 4	4.94	3.6	5	3	5
Q8 4	4.86	4	5	1	6
Q9 3	4.42	4.4	4	1	5.2
Q10 5	6.2	6.4	5	5	5.4
Q11 4	4.67	5.4	4	2	5.8
Q12 7	5.33	6	4	5	6
Q13 4	5.92	5.8	5	3	6.4
Q14 4	5.53	5.6	5	4	5.4

In 2018 pre-test older group, we combined participants with two races or more into a new group, 'Biracial/Multiple races' to reduce the level of factor data. We have six levels of data, which includes 'Asian', 'Caucasian', 'Black/African', 'Hispanic/Latinx', 'Native American', 'Biracial/Multiple races'. From the table, we observe that 'Biracial/Multiple races' has most of the highest means from the questions.

2018 Post-test Older Group					
	Asian	Caucasian	Black/African	Hispanic/Latinx	Native American	Biracial/Multiple races
	Mean	Mean	Mean	Mean	Mean	Mean
Q1	3	5.53	5.6	5	3	6.2
Q2	4	6.25	5.8	5	4	6
Q3	7	5.25	5.2	5	2	6.2
Q4	7	5.72	5.6	6	2	6.2
Q5	4	6.08	6.4	6	6	6.6
Q6	5	6.11	5.6	5	4	6.8
Q7	4	5.14	5.2	5	2	6.2
Q8	4	5.28	5.6	5	1	6
Q9	1	4.39	5.6	5	2	5.2
Q10	4	6.28	6.8	6	5	7
Q11	3	5	6.2	6	1	5.8
Q12	7	5.83	6.2	6	4	6.4
Q13	5	5.92	6.2	6	3	7
Q14	6	5.69	6.4	6	3	6

In the 2018 post-test older group, we combined participants with two races or more into a new group, 'Biracial/Multiple races' to reduce the level of factor data. We have six levels of data, which includes 'Asian', 'Caucasian', 'Black/African', 'Hispanic/Latinx', 'Native American', 'Biracial/Multiple races'. As with the pre-test older group, we observe that 'Biracial/Multiple races' has most of the highest means from the questions. Also, it appears that Hispanic/Latinx reduces the ratings after the program. The group had the highest means in three questions in pre-test but did not have any highest means in post-test.

2019 Pre-test Older Group				
Caucasian	Black/African	Hispanic/Latinx	Other	Biracial/Multiple races
Mean	Mean	Mean	Mean	Mean
Q1	4.93	4.71	3	4	4
Q2	5.15	5.43	3	5	3
Q3	4.77	5.14	3	7	4
Q4	4.81	5.43	3	4	4
Q5	5.7	6.43	6	7	5
Q6	5.37	5.43	3	5	5
Q7	4.52	3.86	4	4	4
Q8	5.37	6.14	4	7	4
Q9	3.85	4.71	2	7	3
Q10	5.15	6.43	5	7	5
Q11	4.74	4.86	4	7	4
Q12	5.63	5.86	3	5	5
Q13	5.59	5.43	3	4	5
Q14	5.85	5.57	4	4	5

In the 2018 pre-test older group, we combined participants with two races or more into a new group, 'Biracial/Multiple races' to reduce the level of factor data. We have five levels of data, which includes 'Other', 'Caucasian', 'Black/African', 'Hispanic/Latinx', 'Biracial/Multiple races'. From the table, we observe that the highest means from the questions are fairly distributed among 'Other', 'Black/African', and 'Caucasian'.

2019 Post-test Older Group				
Caucasian	Black/African	Hispanic/Latinx	Other	Biracial/Multiple races
Mean	Mean	Mean	Mean	Mean
Q1	5.63	5.71	4	7	5
Q2	5.52	6	6	7	6
Q3	5.04	6.14	5	7	6
Q4	5.7	6.29	7	7	5
Q5	6	6.71	7	7	6
Q6	5.59	6.57	6	7	6
Q7	5.07	5.57	3	7	6
Q8	5.22	6.14	7	7	5
Q9	4.07	6.14	3	4	5
Q10	5.96	6.14	6	7	5
Q11	4.7	6.14	4	7	5
Q12	5.74	6.29	5	6	6
Q13	6.19	6.43	6	7	5
Q14	5.93	6.43	5	4	6

In the 2019 pre-test older group, we combined participants with two races or more into a new group, 'Biracial/Multiple races' to reduce the level of factor data. We have five levels of data, which includes 'Other', 'Caucasian', 'Black/African', 'Hispanic/Latinx', 'Biracial/Multiple races'. From the table, we observe that the highest means from the questions are mostly from 'Other' race, however, there is only one observation from this race, so we will need more observations for making conclusions on this. We also observed that if most of the questions, participants from each race are increasing their ratings after the program.

	2018 Pre-test Younger Group			
	Caucasian	Black/African	Hispanic/Latinx	Biracial/Multiple races
	Mean	Mean	Mean	Mean
Q1	4.56	5.25	5	5.2
Q2	5.06	4.63	4	5.4
Q3	4.86	5.5	4	4.2
Q4	4.94	5.63	5	5.4
Q5	5.94	6.13	6	6.2
Q6	5.32	4.38	6	6.2
Q7	4.68	5.38	5	5
Q8	4.74	5.5	5	6
Q9	3.97	5.25	5	5.2
Q10	6.09	6.13	6	6.6
Q11	4.21	5.25	4	4.6
Q12	5.21	5.63	5	5.8
Q13	6	6.75	6	6.2
Q14	5.65	6.38	5	6

In the 2018 pre-test younger group, we combined participants with two races or more into a new group, 'Biracial/Multiple races' to reduce the level of factor data. We have four levels of data, which includes 'Caucasian', 'Black/African', 'Hispanic/Latinx', 'Biracial/Multiple races'. From the table, we observe that the highest means from the questions are mostly from 'Black/African' race and 'Biracial/Multiple races'.

	Caucasian	Black/African	Hispanic/Latinx	Biracial/Multiple races
2018 Post-test Younger Group				
	Mean	Mean	Mean	Mean
Q1	5.41	5.38	6	6
Q2	5.91	5.5	7	6.2
Q3	5.62	5.53	6	6.2
Q4	5.5	5.75	5	6.4
Q5	6.12	6	7	6.6
Q6	5.91	4.88	6	6.6
Q7	4.88	4.88	7	5.8
Q8	5.56	6	5	6
Q9	4.74	5.13	5	5.2
Q10	6.32	7	7	6.6
Q11	4.91	6	5	6
Q12	5.74	5.5	6	6
Q13	6.09	5.75	6	6
Q14	6.09	6.25	5	6.4

In the 2018 pre-test younger group, we combined participants with two races or more into a new group, 'Biracial/Multiple races' to reduce the level of factor data. We have four levels of data, which includes 'Caucasian', 'Black/African', 'Hispanic/Latinx', 'Biracial/Multiple races'. From the table, we observe that the highest means from the questions are mostly from 'Hispanic/Latinx' race and 'Biracial/Multiple races'.

	Caucasian	Black/African	Hispanic/Latinx	Biracial/Multiple races
2019 Pre-test Younger Group				
	Mean	Mean	Mean	Mean
Q1	4.37	5.5	5	3.71
Q2	5.04	5.25	5	3.88
Q3	4.59	4.5	4	4.59
Q4	4.93	5.13	5	4.13
Q5	5.85	6.75	5	4.86
Q6	5.44	4.75	5.5	4.25
Q7	4.19	4.5	4.5	2.75
Q8	4.93	6.13	4.5	3.75
Q9	3.74	4.38	3.5	2.88
Q10	5.81	6.38	7	6
Q11	4.11	5.13	5	3.88
Q12	5.15	5.13	5.5	4.13
Q13	5.41	5.88	4.5	5.5
Q14	5.44	5.88	4	4.25

In the 2019 pre-test younger group, we combined participants with two races or more into a new group, 'Biracial/Multiple races' to reduce the level of factor data. We have five levels of data, which includes 'n/a', 'Caucasian', 'Black/African', 'Hispanic/Latinx', 'Biracial/Multiple races'. Due to race 'n/a' only containing one observation and we think it will not contribute for future use, we decided to remove it from the analysis. It ended up having four levels of data. From the result, we see that the race 'Black/African' has most the of the highest mean from questions.

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	Caucasian	Black/African	Hispanic/Latinx	Biracial/Multiple races
2019 Post-test Younger Group				
	Mean	Mean	Mean	Mean
Q1	5.15	6.13	6	4.88
Q2	5.81	6	6.5	4.75
Q3	5	5.13	5	4.38
Q4	5.67	5.38	6	5.5
Q5	6.11	6.63	6.5	5.75
Q6	5.78	5.5	6	5.5
Q7	4.81	4.63	5.5	4
Q8	5.5	6.38	6	4.75
Q9	3.96	5.75	4.5	2.75
Q10	6.28	6.75	6.5	5.5
Q11	4.69	6.63	5.5	4.5
Q12	5.42	5.88	5.5	4.5
Q13	5.96	6	6	5.25
Q14	5.37	6.5	6	3.63

In the 2019 pre-test younger group, we combined participants with two races or more into a new group, 'Biracial/Multiple races' to reduce the level of factor data. We have five levels of data, which includes 'n/a', 'Caucasian', 'Black/African', 'Hispanic/Latinx', 'Biracial/Multiple races'. Due to race 'n/a' only containing one observation and we think it will not contribute for future use, we decided to remove it from the analysis. It ended up having four levels of data. From the result, we see that the race 'Black/African' has most of the highest mean from questions.

Takeaway: We compare the means for each pre- and post-group.

- Most of the ratings are increasing after the program. We can generally see that the Omaha Girls Rock program does affect the ratings.

- One notable change we found is in 2018 pre-test and post-test younger groups. In pre-test younger group, Black/African and Biracial/Multiple races are the two groups that have the highest means, however, after that the program the two groups that have the highest means turn to be 'Hispanic/Latinx' and 'Biracial/Multiple races'. Thus, we conclude that in the 2018 younger group, Hispanic/Latinx group increases rating more than Black/African group.

- Another notable observation is that in each dataset, Caucasian tend to have lower ratings compared to other groups. For example, we do not observe much yellow highlights in Caucasian groups. Therefore, we would suggest Omaha Girls Rock to focus more on improving ratings of Caucasian group.

- From the descriptive data, we do observe that the participants from different race/ethnicity perform differently in answer ratings.

3. Means for the pre- and post- test groups based on ages

2018 Pre-test Older Group			
Age 13	Age 14	Age 15	Age 16
Mean	Mean	Mean	Mean
Q1 — 5.05	4.92	4.25	6
Q2 — 5.43	5.85	5	6.2
Q3 — 4.86	4.31	4	5.6
Q4 — 5.57	4.62	5	6.5
Q5 — 6.05	5.54	4.88	6.6
Q6 — 5.38	5.08	5.25	5.6
Q7 — 5	4.23	4.38	5.6
Q8 — 5.14	4.38	3.88	5.8
Q9 — 4.95	3.46	4	5.4
Q10 — 6.1	6.23	5.25	6.2
Q11 — 5.43	3.92	4	5.6
Q12 — 5.86	5.08	5.13	5.4
Q13 — 5.95	5.85	5.5	5.6
Q14 — 5.62	5.31	5.13	5.4

In the 2018 pre-test older group dataset, we found two observations of age 12 participants. Since the older group should only include age 13-16, we conclude that those two observations are anomaly data and remove them. The table above shows the means for each age groups, we see that age 16 has most the highest means for questions, followed by age 13.

2018 Post-test Older Group			
Age 13	Age 14	Age 15	Age 16
Mean	Mean	Mean	Mean
Q1	5.62	5.46	4.75	6.2
Q2	6.05	6.08	5.75	6.6
Q3	5.62	5	4.63	6
Q4	5.76	5.54	5.38	6.8
Q5	6.38	5.77	5.99	6.4
Q6	6.1	6	6	6
Q7	5.62	4.92	4.25	5.6
Q8	5.62	5.31	4	6.2
Q9	4.71	4.46	3.13	5
Q10	6.52	6.38	5.88	6.6
Q11	5.67	4.85	3.63	5.2
Q12	6.1	5.77	5.63	6
Q13	6.14	5.85	5.88	6
Q14	6.1	5.62	4.75	5.8

In the 2018 pre-test older group dataset, we found two observations of age 12 participants. Since the older group should only include age 13-16, we conclude that those two observations are anomaly data and remove them. The table above shows the means for each age groups, we see that age 16 has most the highest means for questions, followed by age 13. This result is aligned with the pre-test ratings. Also, the answer ratings are generally increasing after the program.

	2019 Pre-test Older Group			
	Age 13	Age 14	Age 15	Age 16
	Mean	Mean	Mean	Mean
Q1	4.31	5.15	5.17	4.6
Q2	4.62	5.54	5.33	4.8
Q3	5	4.77	4.6	4.8
Q4	4.77	5.15	4.5	4.6
Q5	6.08	5.69	5.83	5.8
Q6	5.31	5.69	4.83	4.8
Q7	4.15	4.77	4	4.2
Q8	5.77	5.69	5	4.8
Q9	3.54	4.62	4	3.8
Q10	6.23	6.15	6	6.2
Q11	4.85	4.85	4.5	4.8
Q12	5.77	5.69	5	5.4
Q13	5.62	5.62	5	5
Q14	5.92	5.85	5.17	5.2

In the 2019 pre-test older group dataset, we found that age 13 and age 14 have most of the highest means among age groups.

2019 Post-test Older Group			
Age 13	Age 14	Age 15	Age 16
Mean	Mean	Mean	Mean
Q1	4.92	6.15	5.67	6
Q2	5.08	6.08	5.83	6
Q3	4.92	5.85	5	5.4
Q4	5.31	6.46	5.33	6.4
Q5	5.62	6.77	6	6.4
Q6	5.46	6.38	5.67	5.6
Q7	4.46	5.92	4.83	5.6
Q8	5.62	6	5	4.4
Q9	3.69	5.38	4.17	4.4
Q10	5.92	6.15	6.17	5.6
Q11	4.46	5.92	4.67	4.6
Q12	5.54	6.46	5.17	5.8
Q13	6	6.69	5.83	6
Q14	5.69	6.62	5.67	5.2

In the 2019 pre-test older group dataset, we found that age 14 have most of the highest means among age groups. We notice that the age 13 group had 8 highest means for questions in pre-test but ended up having 0 highest mean for questions in post-test. They have decreased their ratings in some of the questions (Q5, Q8, Q10, Q11, Q12, Q14). This might be something Omaha Girls Rock can look into.

	2018 Pre-test Younger Group		
	Age 10	Age 11	Age 12
	Mean	Mean	Mean
Q1	4.82	4.86	4.59
Q2	4.94	5.29	4.82
Q3	5.06	4.79	4.76
Q4	5.12	5.14	5.06
Q5	6.12	6.07	5.82
Q6	5	5.86	5.06
Q7	4.76	5	4.76
Q8	5	4.93	5.06
Q9	4.18	4.57	4.29
Q10	6.12	6.71	5.71
Q11	4.59	4.21	4.41
Q12	5.35	5.79	4.94
Q13	6.18	6	6.24
Q14	5.88	5.57	5.88

In the 2018 pre-test younger group dataset, we found that age 11 have most of the highest means among age groups.

	2018 Post-test Younger Group		
	Age 10	Age 11	Age 12
	Mean	Mean	Mean
Q1	5.35	5.43	5.65
Q2	6.06	5.71	5.88
Q3	6.12	5.36	6
Q4	5.65	5.64	5.59
Q5	6.18	6.07	6.24
Q6	5.88	5.93	5.65
Q7	4.29	5.43	5.41
Q8	5.53	6.14	5.41
Q9	4.71	5.29	4.65
Q10	6.47	6.93	6.18
Q11	5.53	5.43	4.71
Q12	5.47	6	5.76
Q13	6	6.43	5.71
Q14	6.35	6.14	5.88

In the 2018 post-test younger group dataset, we found that age 11 have most of the highest means among age groups, then followed by age 10. The distribution of highest means in post-test are fairly aligned with the highest means in pre-test.

2019 Pre-test Younger Group		
Age 10	Age 11	Age 12
Mean	Mean	Mean
Q1	4.22	4.61	4.54
Q2	4.22	5.22	4.79
Q3	4.89	4.70	3.86
Q4	4.89	5.09	4.29
Q5	6.13	5.96	5.5
Q6	4.79	5.48	4.71
Q7	4	4.22	3.64
Q8	4.44	5.26	4.79
Q9	3.44	3.74	3.93
Q10	6.13	6.09	5.86
Q11	3.78	4.35	4.5
Q12	4.89	5.26	4.64
Q13	5.67	5.74	5
Q14	5.78	5.04	5.36

In the 2019 pre-test younger group dataset, we found that age 11 have most of the highest means among age groups.

2019 Post-test Younger Group		
Age 10	Age 11	Age 12
Mean	Mean	Mean
Q1	5.22	5.70	4.86
Q2	5.22	5.96	5.57
Q3	5.11	5.04	4.57
Q4	6	5.78	5.07
Q5	6.44	6.22	5.93
Q6	5.78	5.70	5.64
Q7	4.89	4.74	4.5
Q8	5.44	5.91	5.08
Q9	4.56	4.3	3.54
Q10	5.89	6.39	6.25
Q11	5.33	5.17	4.62
Q12	5.33	5.39	5.31
Q13	5.78	6	5.69
Q14	5.44	5.48	5

In the 2019 post-test younger group dataset, we found that age 10 and age 11 have most of the highest means among age groups. The distribution of highest means in post-test are fairly aligned with the highest means in pre-test.

Takeaway: We compare the means for each pre- and post-group.

- Ratings are generally increasing after the program. We can generally see that the Omaha Girls Rock program does affect the ratings.

- In the older group, highest means are fairly distributed among ages except we do not observe that age 15 has much highest means. In 2018, age 16 has most of the highest means among age groups, while in 2019, age 13 and age 14 has most of the highest means among age groups. We noticed that in the 2019 older group, age 13 has a significant decrease in rating after the program (refer to Q5, Q8, Q10, Q11, Q12, Q14) while participants from other ages increased their ratings after the program. This might be something Omaha Girls Rock can look into.

- On the other hand, in the younger group, we observe that age 10 and age 11 have most of the highest means in questions. It is interesting that in both 2018 and 2019, the age 12 group tends to rate lower than the two other ages in the program.

- As a conclusion, age 12 and age 15 are the two groups that Omaha Girls Rock should focus on to improve ratings.

DATA VISUALIZATION

BASED ON QUESTION:

We have created the stacked bar chart for each data set and combined them together to understand visually, how the responses has varied over the years, from Older to Younger group of girls for each of the fourteen question.

For each of the bar plot the X axis represents the question ratings from 1 to 7. and Y axis represents count of the girls who have selected that rating.

Q1. Response for Question 1 in Pre and Post camp surveys for different groups in the year 2018 & 2019.

In the visualization above, we can see that in the year 2018, the Older group have given mostly 6 out of 7 ratings and their pre and post camp survey results do not vary that much. For the younger group, participants selected both 6 and 7 ratings and the post camp survey ratings are overall more than the pre camp survey.

In the year 2019, we can see a similar distribution for the younger group. However, for the Older group both 6 and 7 ratings seem to be popular.

Q2. Response for Question 2 in Pre and Post camp surveys for different groups in the year
2018 & 2019.
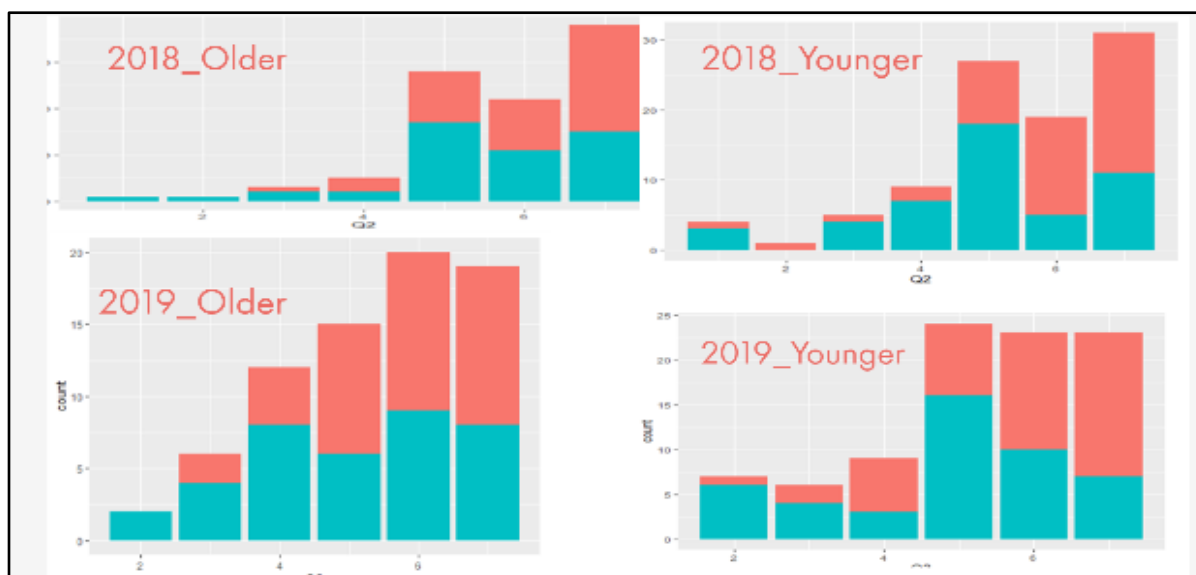
In the visualization above, we can see that in the year 2018, the Older group participants
mostly selected 5 and 7, and the similar distribution can be seen in the younger group as well.

In the year 2019 we can see that the 5, 6 & 7 ratings are favorites for both younger and older
groups for question number 2.

Q3. Response for Question 3 in Pre and Post camp surveys for different groups in the year 2018 & 2019.
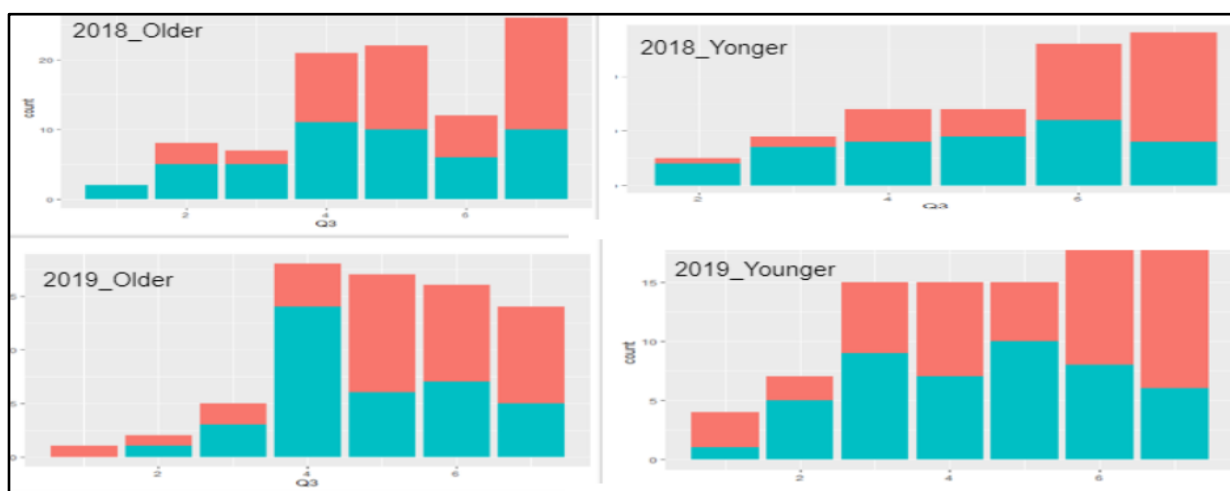
In the visualization above, we can see that in the year 2018, the Older group have mostly selected 4, 5 & 7 ratings and their pre and post camp survey results do not vary that much. For the younger group, the rating distribution is in increasing pattern (from 1 to 7).

In the year 2019, we can see a similar distribution for the younger group. However, for the Older group post camp survey 4 rating is mostly selected.

Q4. Response for Question 4 in Pre and Post camp surveys for different groups in the year 2018 & 2019.
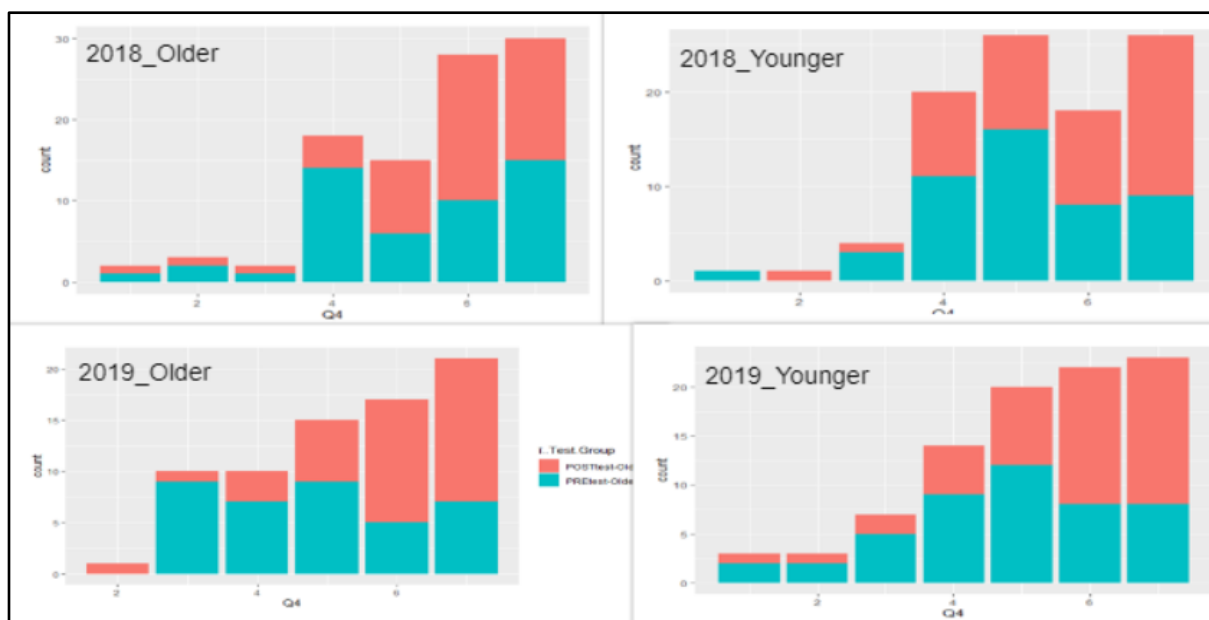
In the visualization above, we can see that in the year 2018, the Older group have mostly selected 6 and 7 ratings and their pre and post camp survey result does not vary that much. For the younger group, they selected both 5 and 7 ratings and their post camp survey ratings are generally higher than the pre camp survey.

In the year 2019 we can see a similar distribution for the younger and older groups, the rating distribution is in increasing pattern (from 1 to 7).

Q5. Response for Question 5 in Pre and Post camp surveys for different groups in the year 2018 & 2019.
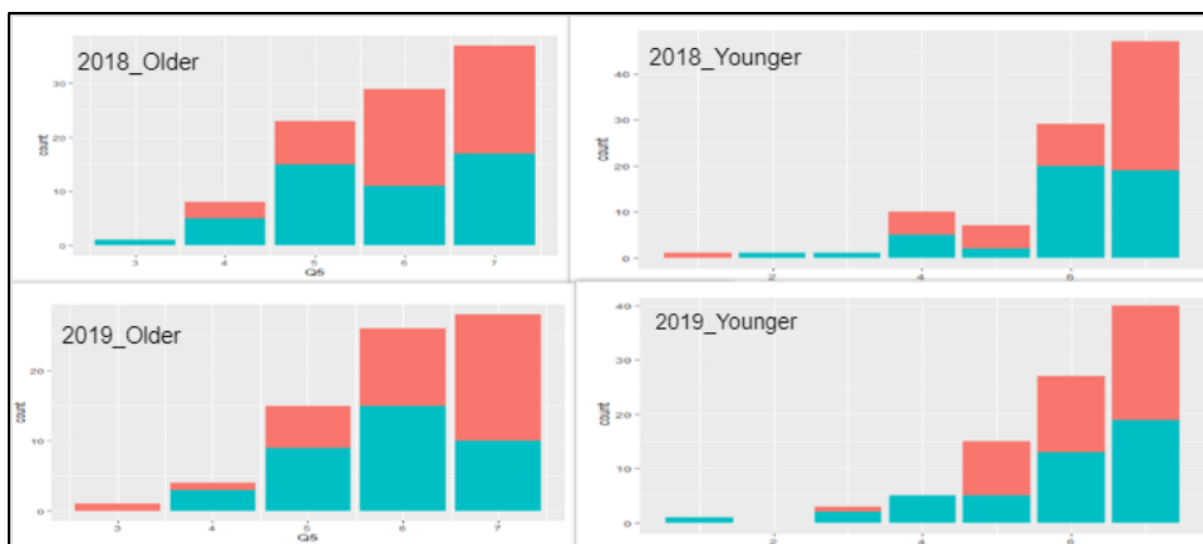
In the visualization above, we can see that for the years 2018 & 2019 for question 5, both older & younger groups have shown an increasing pattern in the answer ratings (from 1 to 7). Interestingly, in 2018 and 2019 older groups, there were no participants rated 1 and 2. The similar situation can be observed in younger groups.

Q6. Response for Question 6 in Pre and Post camp surveys for different groups in the year 2018 & 2019.
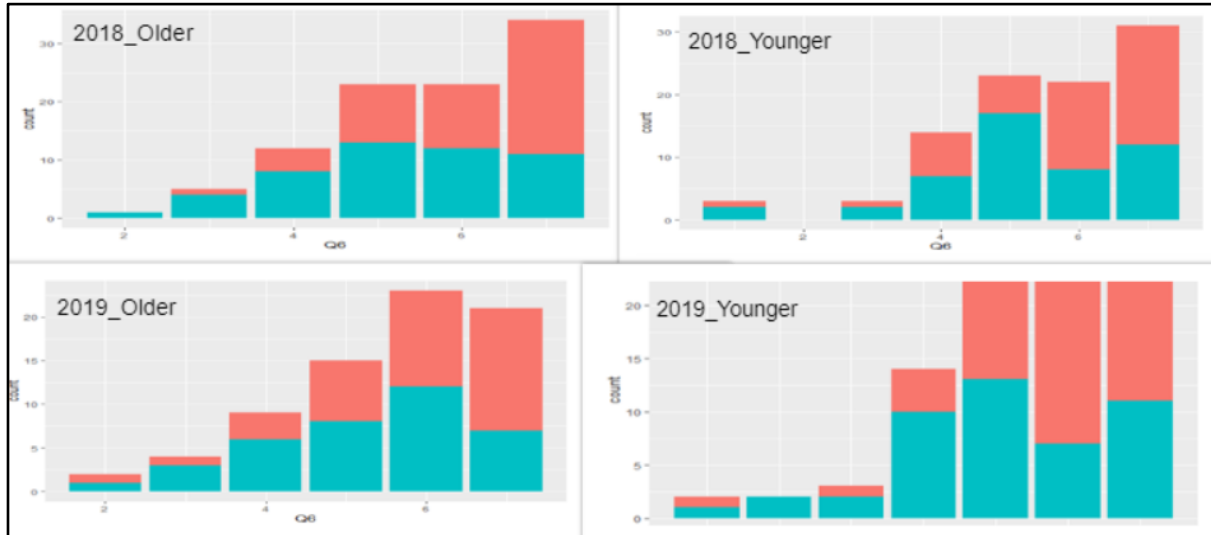
In the visualization above, we can see that for the years 2018 & 2019 for question 5, both older & younger groups have shown an increasing pattern in the answer ratings (from 1 to 7). We also cannot see much variation between the pre and post camp survey apart from the younger group in 2018. We can see that not many participants have chosen ratings 1-3.

Q7. Response for Question 7 in Pre and Post camp surveys for different groups in the year 2018 & 2019.
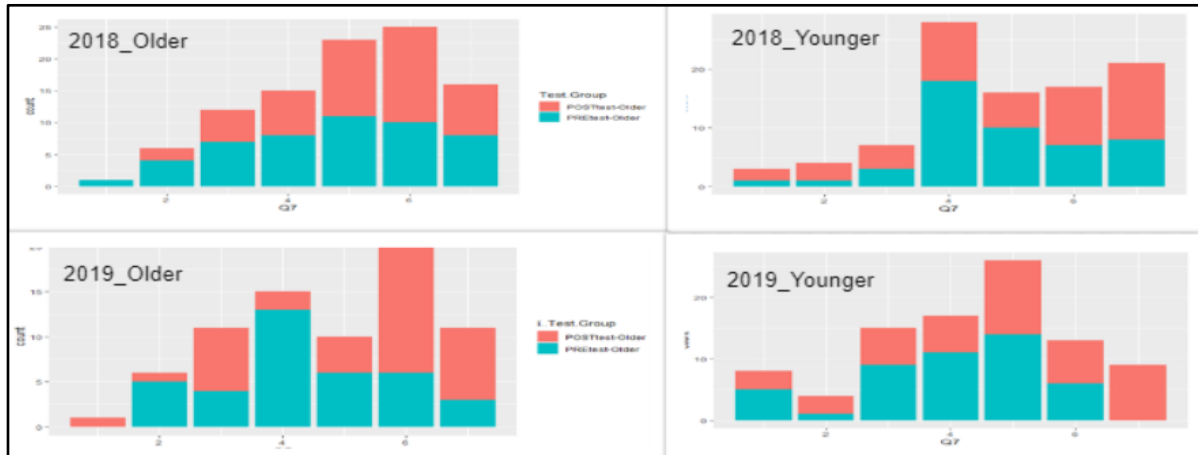
In the visualization above, we can see a variation from answer rating selection from the older and younger groups. For the 2018 Older group, the most common answer ratings are 5 & 6 whereas for the younger group, 4 is mostly rated in pre camp survey, and after the program rating 6 and 7 increased.

For 2019 Older group, rating 4 is chosen popularly in the pre camp survey while 6 is popularly selected in post camp survey which implements after the camp more girls would feel comfortable to try a new and different social situation.

Q8. Response for Question 8 in Pre and Post camp surveys for different groups in the year 2018 & 2019.

In the visualization above, we can see an increasing trend in ratings (from 1 to 7) for both the older and younger groups in 2018 & 2019. The higher ratings 5, 6, and 7 are more popular among participants.

Q9. Response for Question 9 in Pre and Post camp surveys for different groups in the year 2018 & 2019.
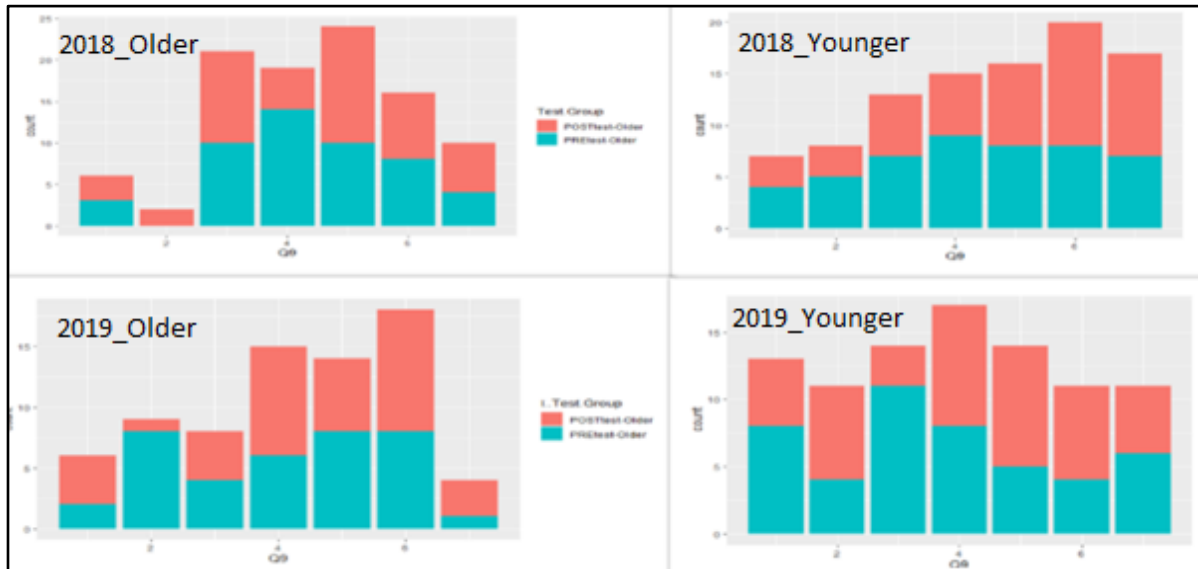
In the visualization above, we can see a variation from answer rating selection from the older and younger group. For the 2018 Older group, the most common answer ratings are 3,4,5 whereas for the younger group the ratings are increasing and do not differ that much between pre and post survey.

For the 2019 Older group, ratings 4, 5, and 6 are popular and very few participants have chosen rating 7. For the younger group in 2019, distribution of ratings is pretty much the same following previous year.

Q10. Response for Question 10 in Pre and Post camp surveys for different groups in the year 2018 & 2019.
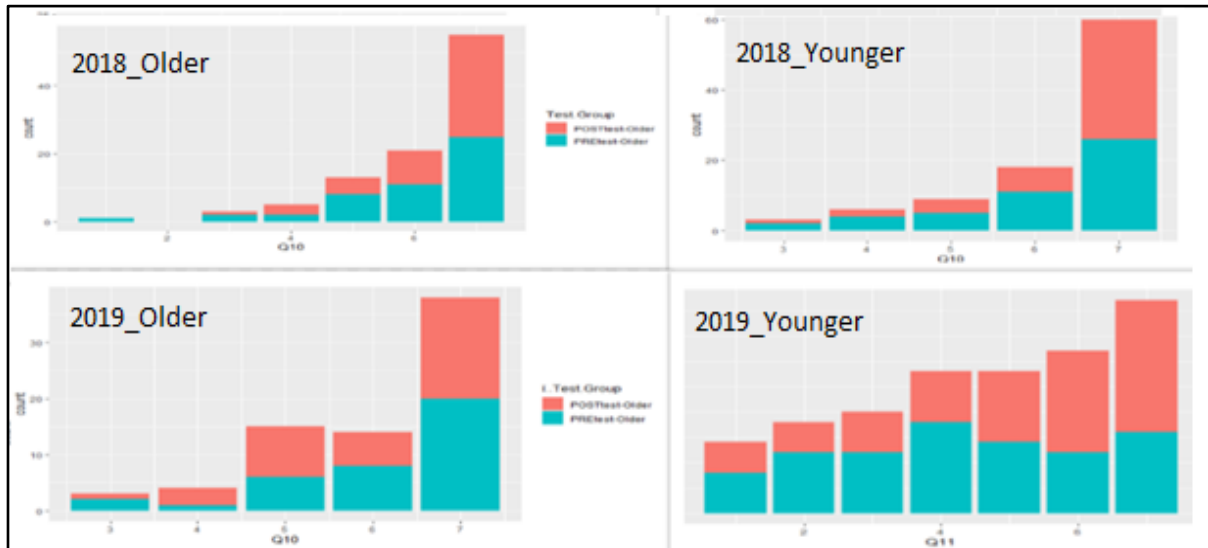
In the visualization above, we can see an increasing trend like Q5 for both the older and younger groups in 2018 & 2019. Also, we observe that in 2018 younger and 2019 older groups, the answer ratings 1 and 2 are not selected.

Q11. Response for Question 11 in Pre and Post camp surveys for different groups in the year 2018 & 2019.

In the visualization above, we can see variations in the answer rating in the older and younger group. For the 2018 Older group, the most commonly selected ratings are 5,and 6 whereas for the younger group the ratings are increasing, and post camp survey selection of rating 7 is higher among the younger group.

Also, many participants from the 2019 Older group have rated 5. However, for the 2019 younger group, the ratings are increasing from 4 to 7, and 7 is the most popularly selected rating.

Q12. Response for Question 12 in Pre and Post camp surveys for different groups in the year 2018&2019.
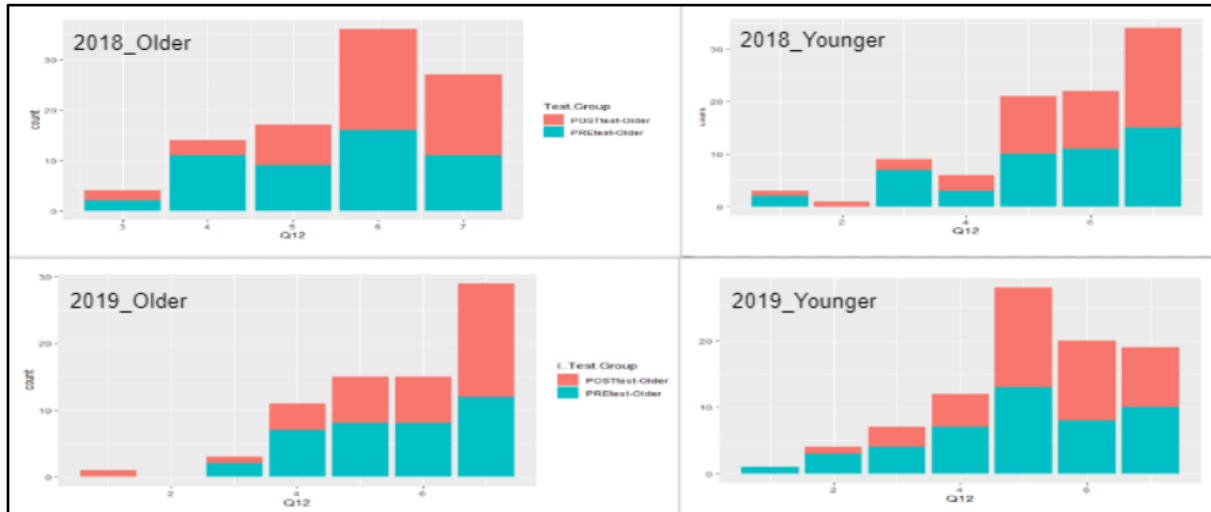
In the visualization above, we can see none of the participants from the Older group has selected 1 or 2 ratings in both pre and post camp survey, and most of them have selected rating 6.

The 2019 Older group has shown an increased pattern in the ratings in both pre and post survey. Also, for the younger group in 2019, rating 5 is most popular.

Q13. Response for Question 13 in Pre and Post camp surveys for different groups in the year 2018 & 2019.
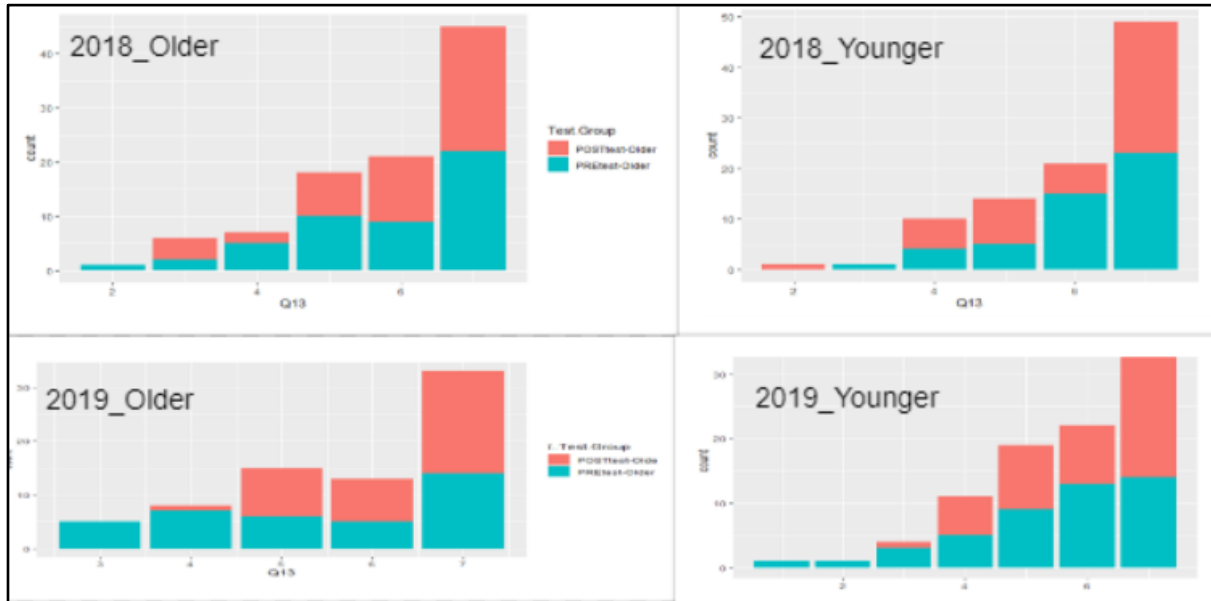
In the visualization above, we can see in 2018 & 2019, most of the participants are giving a rating of 7. The charts are showing an increased pattern from rating 3 to rating 7.

In the above visualization we can see an increasing trend in both the older and younger groups for both the year 2018 & 2019. In the younger group, we observed that the rating 7 is the most popular answer.

BASED ON AGE:

Next, we took age as a factor and tried to visualize how it has affected the survey response over the time for different age groups in post camp survey. Since it will be a lot of visualizations if we include all the 14 questions so for the analysis of this paper, we used only question 7 and 14 and rest of the visualization we have kept in the appendix section for further references.

1. Response for Question 7 in Post camp surveys for different age groups in the year 2018 & 2019.
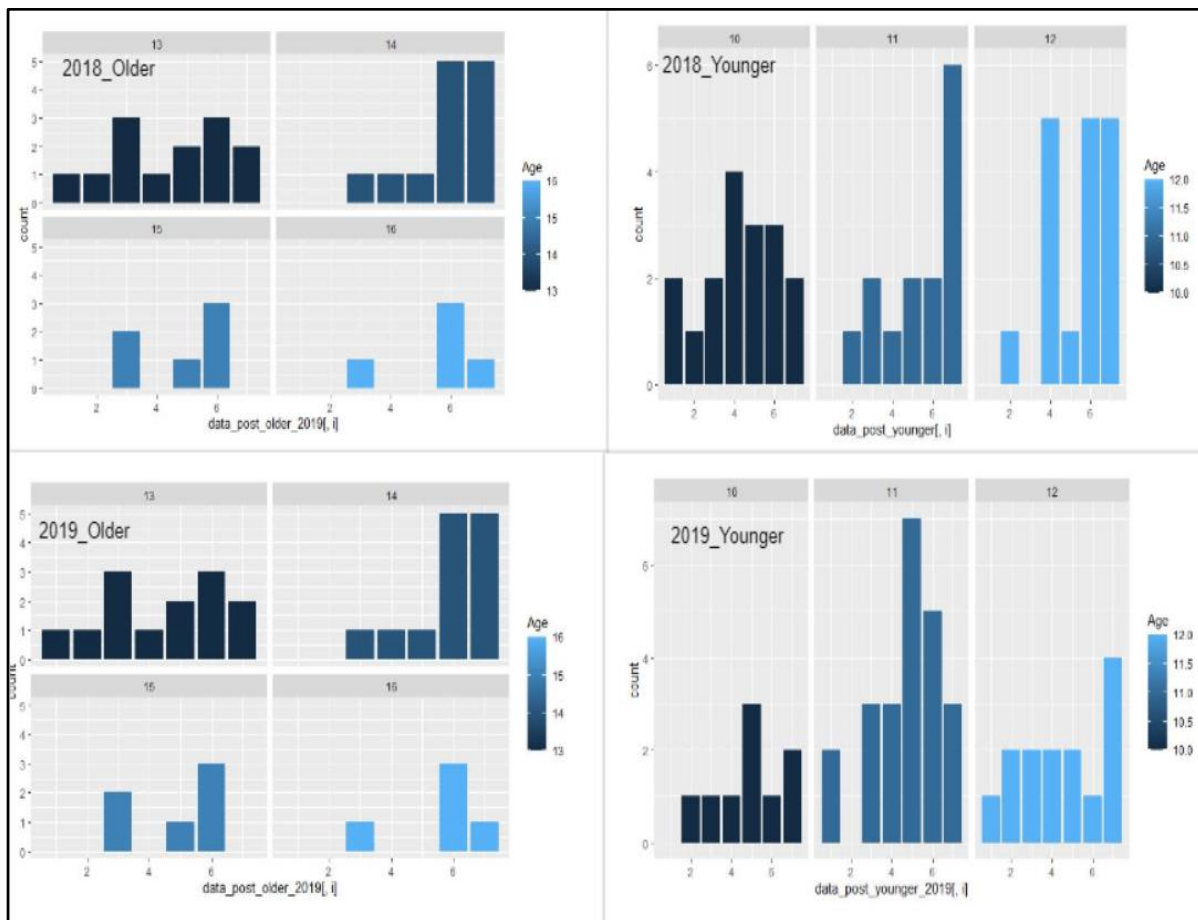
In the above visualization, for 2018 Older group most of the girls who have responded is 13 years and 14 years old for the question 7, as part of post camp survey. For the 14 years old ,

most of them selected rating 6 & 7 and the trend remain same in the for the following year. For the younger groups we can see the maximum participation in the post camp survey is from the 10 & 11 years old. And most of the 11 years old has given a rating of 7. For the 12 years old, the rating of Q7 is tie between 4,6 & 7. In 2019 Younger group however we see a trend that the 11 years old were mostly participate in the survey, it is the same batch as in year 2018 when they were 11 years old. It seems like an enthusiastic batch, and this time most of the girls from 11 years old has selected rating 5 unlike the previous year. So, we can say their experience is bit disappointing in the 2019 OGR camp.

2. Response for Question 14 in Post camp surveys for different age groups in the year 2018 & 2019.
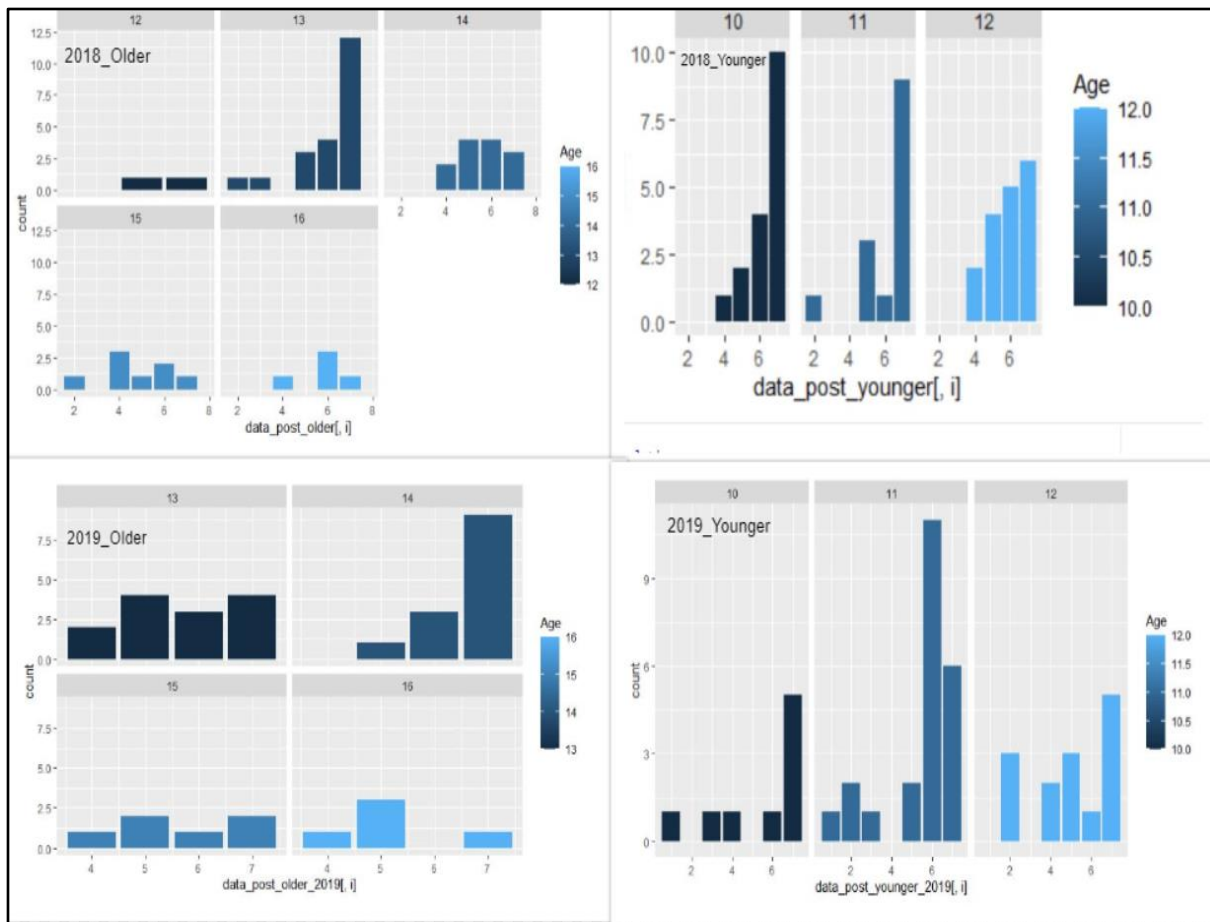
In the above visualization, for 2018 Older group most of the girls who have responded is 13 years old for the question 14. For the 13 years old, most of them selected the highest rating.

and the trend remain same in the for the following year. For the younger groups we can see that the maximum participation in the post camp survey is from the 10 & 11 years old. And most of the 10 years old has given a rating of 7. For the 12 years old, the rating of Q14 is tie between 5,6 & 7. In 2019 we see the similar trend for both younger & older group. However for the younger groups in 2019 we can most of the lower ratings are evenly distributed which suggest that more than 1 girl felt the same way about the camp ,and for 12 years almost 3 girls have given 2 rating in the post camp survey.

BASED ON RACE:

3. Response for Question 7 in Post camp surveys for different Race groups in the year 2018&2019.

In the above visualization, we used facet-wrap graph by taking race as a factor, we wanted to see how the responses in the post camp survey, depends on the different race. One common we can see from the graph that most of the survey participants are Caucasian followed by black/African. We see very little presence of other races in the post survey of Q7. Another thing is ratings from the Caucasian and black/African girls varies a lot. For the Caucasian girls we can see mostly the higher ratings whereas for the other groups it's in the lower range.

4. Response for Question 14 in Post camp surveys for different Race groups in the year 2018 & 2019.

In the above visualization, we took the post camp survey for question number 14 ,and we can see the same trend as in Q7 .Mostly the Caucasian girls have actively participated in the survey and their ratings are also in the higher range, whereas their immediate followers have selected a comparatively lowers rating for the Q14. We also see very little presence of other races in range.

CORRELATION ANALYSIS:

In the correlation part, we take the correlation graphs of the four pre-test groups (2018 and 2019) as reference.

2019_Older   2019_Younger
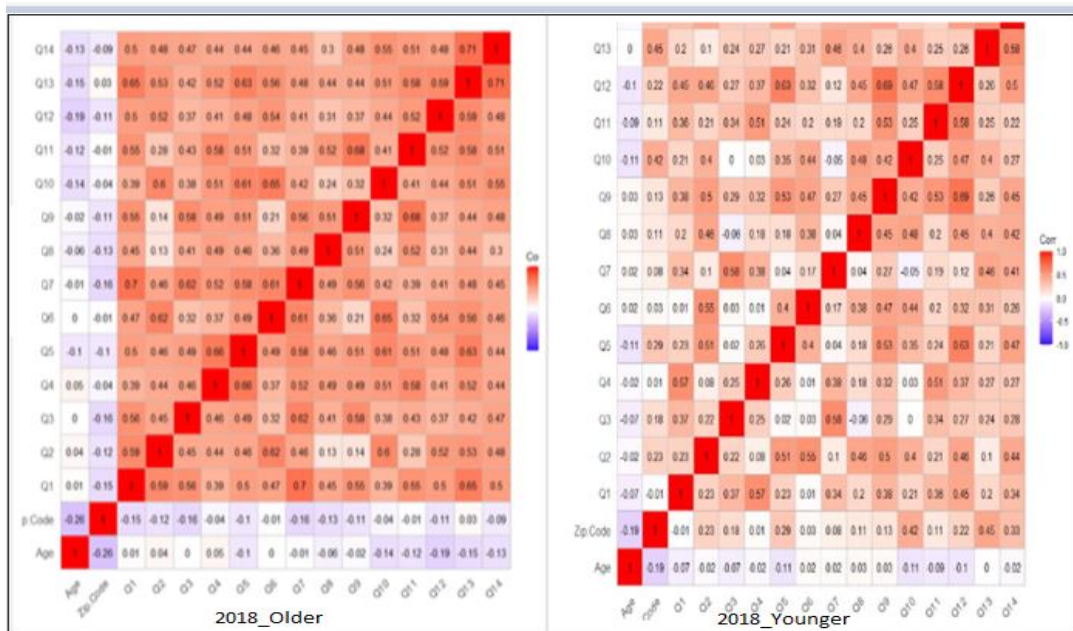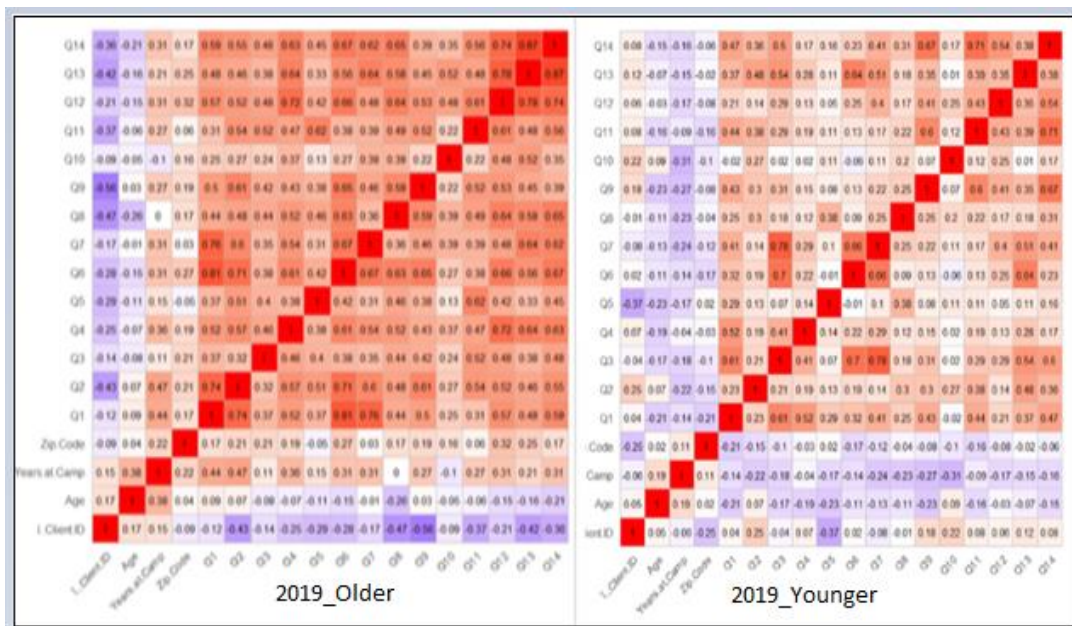
The outcomes of correlation plots for all datasets are listed in the table below:

Datasets	Highly Correlated Questions	Correlation Coefficient
2018 Pre-test older group	Q1 and Q7	0.7
	Q13 and Q14	0.71
2018 Post-test older group	Q1 and Q7	0.71
	Q1 and Q9	0.71
	Q4 and Q12	0.75
	Q6 and Q13	0.76
	Q7 and Q8	0.81
	Q7 and Q13	0.72
	Q10 and Q13	0.72
	Q11 and Q14	0.87

	Q12 and Q13	0.77
	Q12 and Q14	0.74
	Q13 and Q 14	0.76
2019 Pre-test older group	Q1 and Q2	0.74
	Q1 and Q6	0.81
	Q1 and Q7	0.76
	Q2 and Q6	0.71
	Q4 and Q12	0.72
	Q12 and Q13	0.78
	Q13 and Q14	0.87
2019 Post-test older group	Q1 and Q2	0.7
	Q1 and Q4	0.75
	Q2 and Q6	0.75
	Q3 and Q7	0.73
	Q3 and Q12	0.7
	Q4 and Q5	0.8
	Q5 and Q6	0.71
	Q7 and Q12	0.72
2018 Pre-test younger group	None	
2018 Post-test younger group	Q2 and Q13	0.72
2019 Pre-test younger group	None	
2019 Post-test younger group	Q3 and Q6	0.7
	Q3 and Q7	0.78
	Q11 and Q14	0.71

We took a few highly correlated questions pairs in our analysis for interpretation. We chose some of the question pairs that appeared multiple times in the table because we believe these questions are more correlated to each other when they appear multiple times in different datasets.

Q1 and Q7

Q1: Start a conversation with a boy or girl you don't know very well.

Q7: Put yourself in a new and different social situation.

It makes intuitive sense that Q1 and Q7 are highly correlated. When people are starting a conversation with someone they do not know very well, they are actually making step to put themselves in a new and different social situation. People often get anxious in this situation because they are not in their comfort zone. This is the same as having uncomfortable feeling when you are meeting a new friend in social situation or meeting a new client in business because you need to think of how to start a conversation to make a good impression.

Q13 and Q14

Q13: Be involved in group activities.

Q14: Find someone to spend recess with.

Although it has no direct relationship between finding someone to spend recess with and to be involved in group activities, we believe there are something related between them. One of the possible relationships is the social skill level of the student. If student has a good social skill, he or she can be easily involved in group activities, while at the same time he or she can easily find someone to spend recess with because of having many friends.

Q11 and Q14

Q11: Get invited to a party that's being given by one of the most popular kids in the class.

Q14: Find someone to spend recess with.

The question 11 and question 14 makes sense to be high correlated. If this student provides good impression to others, he or she will likely get invited to a party held by most popular kids in class and getting easy to find someone to spend recess with at the same time. We notice that both Q11 and Q14 highly correlated pairs appear in post-test group, we speculate that it might be a skill that student learned from the program that provide the ability for these two situations.

Q12 and Q13

Q12: Keep up your side of the conversation.

Q13: Be involved in group activities.

Q12 and Q13 can be highly correlated when students possess good verbal communication skill. When students possess good verbal communication skill, they can keep up their side of the conversation as well as getting involved in group activities by keep providing their personal opinions in a group.

Q3 and Q7

Q1: Join a group of kids in the school cafeteria for lunch.

Q7: Put yourself in a new and different social situation.

Q1 and Q7 can be highly correlated because the similarity of these events. When students join a group of kids in the school cafeteria for lunch, it is a situation that students are meeting new friend and so they are putting themselves in a new and different social situation.

RESEARCH QUESTIONS

Through our Statistical analysis we are trying to answer the following questions from pre and post survey data .

- **Research question 1:** Are there significant differences in answer ratings for various outcomes in the younger group and the older group? Outcomes are the ratings per question, often measured on a scale from 1-7, etc. This will help OGR to better understand which aspects significantly improve over time and identify aspects that do not show a significant change yet.

- **Research question 2:** Does the race/ethnicity of participants influence the change in scores for various questions over time? Do outcomes (e.g., changes in scores) differ based on the race/ethnicity of the students? Is there a significant change for one ethnicity, but not the other?

- **Research question 3:** What is the age of participants that has the most significant improvement over time? Does age of the participants matter and influence the change in response of the pre & post survey of the summer camp?

OUTLOOK OF PLANNED STATISTICAL METHODS

- **Research question 1:** To test the significant differences of various outcomes in the younger group and the older group, we plan to use a completely randomized design ANOVA test for each of the questions. Since the research question is asking for the differences between younger and older groups, we think the year of data does not make a difference in analysis and we will combine the 2018 and 2019 observations. The planned steps are:

    1. Split data into four parts: Pretest_younger, PostTest_younger , PreTest_older, and PostTest_older. Each of these datasets contains 2018 and 2019 observations. Each dataset has Q1 to Q14 as our analysis target.

    2. We will calculate the changes in scores for each question, for changes = post rating – pre rating. So, now we will have two datasets: Changes_younger and Changes_Older, which recorded the changes of the younger and older group.

3. Then, we will split these observations into 14 datasets: rq1q1, rq1q2, …, rq1q14. These 14 datasets include two columns: Younger and Older, which record the changes of participants for q1 to q14.

4. We will use 'Younger' and 'Older' as treatments and run a completely randomized design ANOVA test for each question, and we will examine the average change in score is different across groups by looking at F-statistics and p-values.

- **Research question 2:** To test whether the race/ethnicity of the participant influences their survey responses, we plan to use a completely randomized design ANOVA test for each of the questions. Since the research question is asking for the differences among races, we think the year of data does not make a difference in analysis and we will combine the 2018 and 2019 observations. The planned steps are:

  1. Split data into four parts: Pretest_younger, PostTest_younger , PreTest_older, and PostTest_older. Each of these datasets contains 2018 and 2019 observations. Each dataset has Q1 to Q14 as our analysis target.

  2. We will calculate the changes in scores for each question, for changes = post rating – pre rating. So, now we will have two datasets: Changes_younger and Changes_Older, which recorded the changes of the younger and older group.

  3. Then, we will split these observations into 14 datasets: rq2q1, rq2q2, …, rq2q14. These 14 datasets include multiple columns with the races of participants, we combined races that have minimum observations such as 'Asian', 'Hispanic/Latinx', and 'Native American'. So, for each rq2q1, rq2q2, …, rq2q14 we have four columns: 'Caucasian', 'Black/African', 'Asian, Hispanic, and Native American', and 'Biracial/Multiple races'. Each row records the changes of participants.

  4. We will use races as treatments and run completely a randomized design ANOVA test for each question, and we will examine the average change in score is different across groups by looking at F-statistics and p-values.

- **Research Question 3:** To test what age of participants has the most significant improvement over time, we plan to use data visualization to answer that. Also, to test if the age of the participants matters and influence the change in response of the pre & post survey of the summer camp, we plan to use a completely randomized design ANOVA test for each question. Since the research question is asking for the differences among ages, we think the year of data does not make a difference in analysis and we will combine the 2018 and 2019 observations. The planned steps are:

  1. Split data into four parts: Pretest_younger, PostTest_younger , PreTest_older, and PostTest_older. Each of these datasets contains 2018 and 2019 observations. Each dataset has Q1 to Q14 as our analysis target.

  2. We will calculate the changes in scores for each question, for changes = post rating – pre rating. So, now we will have two datasets: Changes_younger and Changes_Older, which recorded the changes of the younger and older group.

  3. Then, we will split these observations into 14 datasets: rq1q1, rq1q2, …, rq1q14. These 14 datasets include seven columns: 10, 11, 12, 13, 14, 15, 16, which are the ages of the participants. Each row will record the change of the participant.

  4. We will use ages as treatments and run a completely randomized design ANOVA test for each question, and we will examine the average change in score is different across groups by looking at F-statistics and p-values.

HYPOTHESES AND SELECTED STATISTICAL TESTS

Research question 1: To test if there are significant differences in answer rating outcomes in the younger group and the older group, we perform ANOVA test to compare the difference of means of pre- and post- test. First, we calculate the change in scores for each question (Change = post rating – pre rating) for each participant. Then, we use the Younger group (Age 10-12) and Older group (Age 13-16) as treatments and run completely randomized design ANOVA test for each of the question. We can then draw to conclusion if there are any significant differences in answer ratings for various outcomes in the younger group and the older group. Our hypotheses are:

H_0: μYounger = μOlder

H_a: Not all the means are equal

	F statistics	p-value
Q1	0.5298	0.4677
Q2	2.0772	0.1513
Q3	0.1095	0.7411
Q4	0.1	0.7522
Q5	0.0449	0.8325
Q6	0.2401	0.6248
Q7	0.8875	0.3474
Q8	1.1749	0.2799

Q9	1.1013	0.2954
Q10	0.0134	0.9081
Q11	4.5218	0.03485
Q12	0.0418	0.8382
Q13	3.9503	0.04841
Q14	0.2069	0.6498

We use a level of significance of $\alpha = 0.05$ for the test. For Q1 to Q14, the p-value of Q11 and Q13 are less than or equal to 0.05, so we reject H_0 for Q11 and Q13 and we do not reject H_0 for all other questions.

Conclusion: Therefore, we are 95% confident for Q11 and Q13, there are significant differences in answer ratings for various outcomes in the younger group and the older group. However, we did not find significant differences for all other questions.

	Younger Group	Older group
Mean changes for Q11 (change = post rating – pre rating	0.747	0.25
Mean changes for Q13 (change = post rating – pre rating	0.032	0.452

Research question 2: To test whether race/ethnicity of the participants influence the change in score for various questions over time, we perform ANOVA test to compare the difference of means of pre- and post- test. First, we calculate the change in scores for each question (Change = post rating – pre rating) for each participant. Then, we use the race/ethnicity as treatments and run completely randomized design ANOVA test for each of the question.

In the dataset, we combined races Asian, Hispanic, and Native American, Other into "Others" due to low observations for each of the race. Also, we removed any "n/a" observation in race. Our hypotheses are:

H_0: µCaucasian = µBlack/African = µBiracial/Multiple races = µOthers

H_a: Not all the means are equal

	F statistics	p-value
Q1	0.5688	0.6363
Q2	0.6579	0.579
Q3	0.5084	0.677
Q4	1.1855	0.3168
Q5	2.541	0.058
Q6	0.8882	0.4485
Q7	1.4978	0.2169

Q8	0.1452	0.9326
Q9	1.2203	0.3039
Q10	0.7624	0.5166
Q11	1.8342	0.1427
Q12	0.1151	0.9512
Q13	2.0367	0.1105
Q14	0.9479	0.4188

We use a level of significance of $\alpha = 0.05$ for the test. For Q1 to Q14, none of the p-value is less than or equal to 0.05, so we do not reject H_0 of any questions.

Conclusion: For all questions, we do not reject H_0. Thus, the evidence is not sufficient to stated that the mean changes is different across different race groups.

Research question 3:

What is the age of participants that has the most significant improvement over time? Does age of the participants matter and influence the change in response of the pre & post survey of the summer camp?

To find out which age plays the most important role to the change rate, we divide the data by age. With seven kinds of age, we divided the age into seven parts. The calculate method is the same as the test above and we get the result as following. From the two charts below, we know that for the data of 2018, the most significant influence age is eleven years old; for the data of 2019, the most significant influence age is ten years old. So, the younger age people, specifically 10 years old and 11years old has more significant improvement over time.

ChangeRate By Age 2018
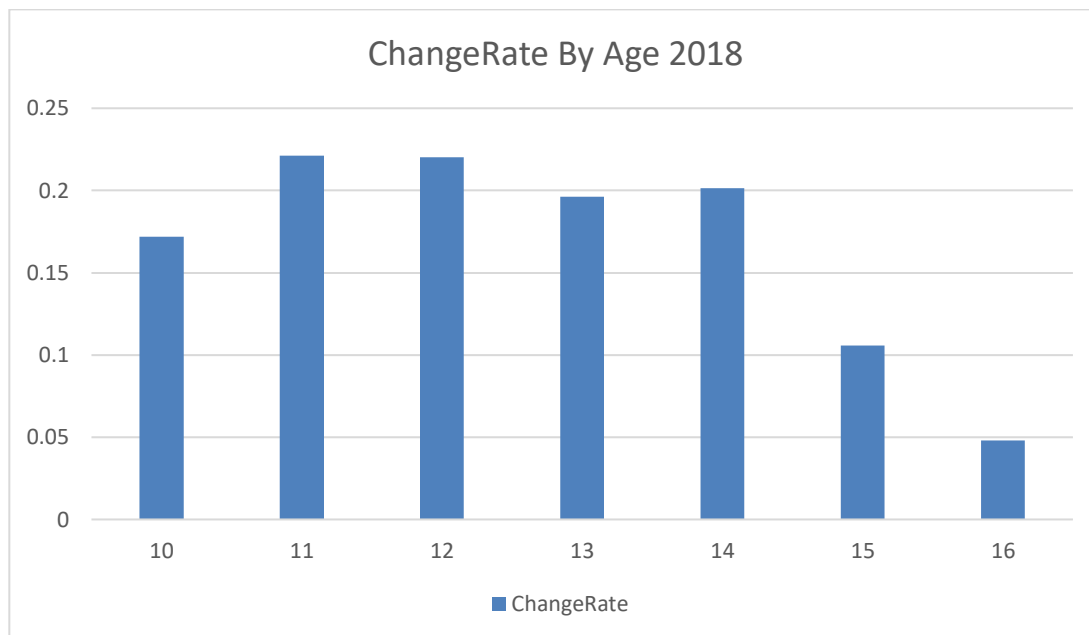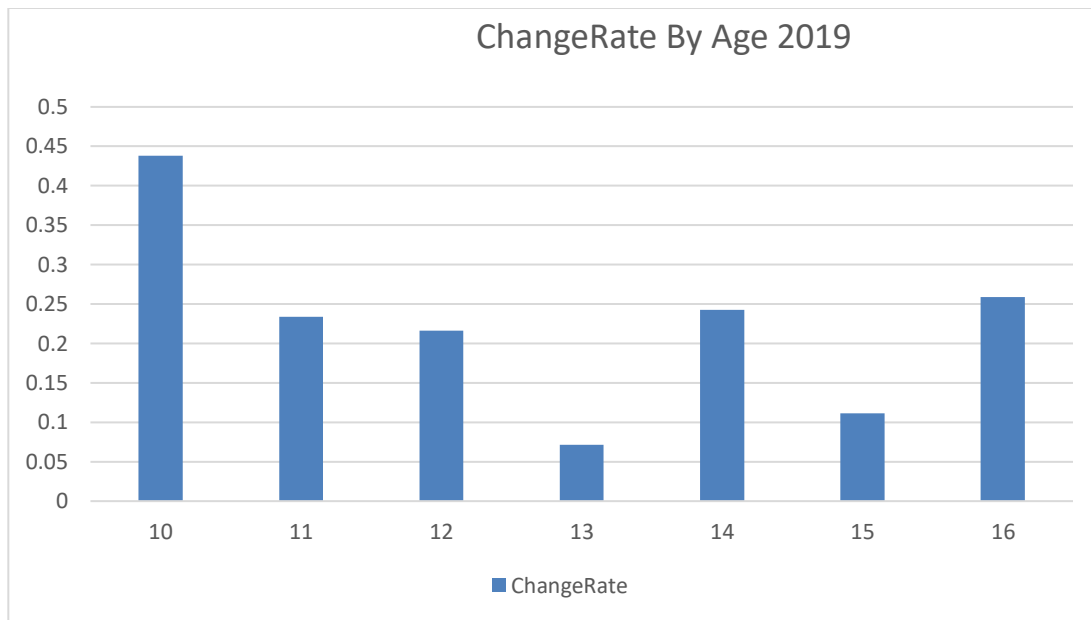
To find out if the age of the participants matter and influence the change in response of the pre & post survey of the summer camp, we perform ANOVA test to compare the difference of means of pre- and post- test. First, we calculate the change in scores for each question (Change = post rating – pre rating) for each participant. Then, we use the ages as treatments and run completely randomized design ANOVA test for each of the question

	F statistics	p-value
Q1	0.223	0.9692
Q2	0.7312	0.6251
Q3	0.4724	0.8282
Q4	0.8746	0.5148

Q5	0.894	0.5006
Q6	1.244	0.2862
Q7	0.9122	0.4875
Q8	1.24	0.2882
Q9	1.5406	0.1676
Q10	0.4753	0.8261
Q11	3.6198	0.0021
Q12	0.869	0.5189
Q13	1.2959	0.2615
Q14	1.1765	0.321

We use a level of significance of $\alpha = 0.05$ for the test. For Q1 to Q14, the p-value of Q11 is less than or equal to 0.05, so we reject H_0 for Q11 and we do not reject H_0 for all other questions.

Conclusion: Therefore, we are 95% confident for Q11, there is a significant difference in answer ratings for various outcomes among ages. However, we did not find significant differences in all other questions.

	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	Age 16
Mean changes for Q11 (change = post rating – pre rating	1.154	0.972	0.182	0	1	-0.143	-0.3

SUMMARY & CONCLUSION

The analysis of this research is based on the questions 1-14 of the questionnaires answered by girls of different age groups over the two years after attaining OGR summer camps. We have tried to identify which factors influenced the Survey response most and some other insight that may be helpful for OGR to plan activities for future Summer Camps. All our observations are based on descriptive statistics, visualization and hypothesis testing. For each question, we can see that the pattern for answering remains similar for both the age groups. The group that has given rating to a particular question did not change their opinion that much in two different years. But if we compare the responses between an older and younger group, we can clearly see the difference in ratings. So, from these observations, we can ascertain that age is really a changing factor whereas time is not. In the hypothesis testing part, we concluded that we are 95% confident for Q11 and Q13, there are significant differences in answer ratings for various outcomes in the younger group and the older group. However, we did not find significant differences for all other questions. For Q11, the mean changes for the younger group is +0.747 and the mean changes for older group is +0.25. For Q13, the mean changes for the younger group is +0.032 and the mean changes for the older group is +0.452. Therefore, we see that the program affects younger and older groups differently in these questions.

Now if we take age as a factor for the older group, we observe a large portion of the participants are age 13. For the younger group, the participants who are age 10, 11 and 12 have actively participated. This shows that the younger kids are more enthusiastic in voicing their opinion. From the data tables, we observed that age 12 and age 15 have overall lower ratings compared to participants from other ages. Thus, we suggest Omaha Girls Rock to focus on improving the ratings for participants from these two age groups. Since age 12 is the oldest in the younger group, and age 15 is around the oldest in the older group, we would recommend to letting these participants be the small group leaders and lead the small group activities. In that way, they could more actively participate in the program and it may result in an increased rating. From the hypothesis testing part, we concluded that we are 95% that there is a significant difference in answer ratings among ages for Question 11. The question

11 is "Get invited to a party that's being given by one of the most popular kids in the class". We observed that the mean changes vary among ages. Participants from age 12, age 13, age 15, and age 16 had minimal changes. Thus, we would recommend Omaha Girls Rock to take note on this when designing their program.

Next, considering race as a factor, we can observe that most of the participants were from a Caucasian group followed by Black African and a very little participation from minority groups. The more probable reason for this may be due to a lesser minority population within the camp. Some useful findings we have are that in the 2018 younger group, Hispanic/Latinx group increases rating more than Black/African group. We would suggest Omaha Girls Rock to look for the reason, such as if there is any particular activity in the 2018 program that would lead to race discrepancy results as it might be useful for designing future activities. On top of that, we generally observe that Causasian tend to have lower ratings compared to other groups. We would suggest Omaha Girls Rock to focus on improving ratings for Caucasian groups. In the hypothesis testing part, we do not have sufficient evidence to state that the mean changes are different across different race groups.

On the other hand, an interesting finding from our correlation analysis is that Question 1 & 7 are highly correlated, although the questions at a first glance may look like they are not related at all. One of the reason for this may be, as we discussed earlier that both questions deal with a social aspect of growing up and hence the high correlation. There are few more high-correlated pairs, and we have provided possible reasons causing the correlation in our interpretation part.

Overall, we can conclude that pre and post camp survey result are not drastically different from each other apart from a few questions. It could be both good and bad, the good thing is that there is a consistency in the rating which proves that Omaha Girls Rock is maintaining their standards. Now in order to get more popularity and high ratings among all the age groups of girls, they can try to include more interesting activities in the camp. Another factor we felt is that it would be really nice if Omaha Girls Rock can attract more diverse participants in the camp so that participants from different minority groups can voice their opinion which will eventually help them to build the great Omaha Community .

APPENDIX

2018 Older Group Post Camp Survey Bar Chart taking Race as factor.

Q1 : Start a conversation with a boy or girl you don't know very well- of the survey.

Q2. Express your opinion to a group of kids discussing a subject of interest to you.

Q3. Join a group of kids in the school cafeteria for lunch.

Q4. Work on a project with a student you don't know very well.

Q5. Help make a new student feel comfortable with your group of friends.

Q6. Share with a group of kids an interesting experience you once had.

Q8. Volunteer to help organize a school dance.

Q9. Ask a group of kids who are planning to go to a movie if you can join them.

Q10. Stand up for your rights when someone accuses you of doing something you didn't do.

Q11. Get invited to a party that is being given by one of the most popular kids in the class.
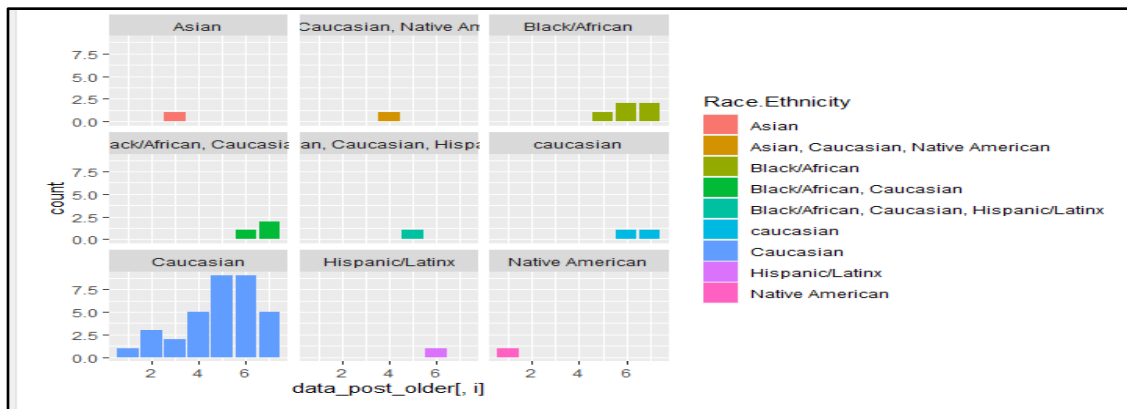
Q12. Keep up your side of the conversation.
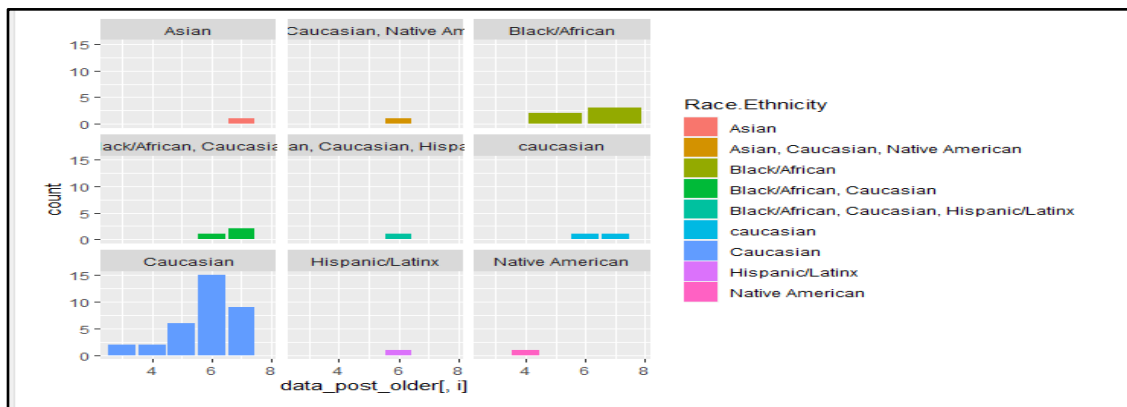
Q13. . Be involved in group activities.

2018 Younger Group Post Camp Survey Bar Chart taking Race as factor.

Q1. Start a conversation with a boy or girl you don't know very well- of the survey.

Q2. Express your opinion to a group of kids discussing a subject of interest to you.

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Q4. Work on a project with a student you don't know very well.

Q5. Help make a new student feel comfortable with your group of friends.

Q6. Share with a group of kids an interesting experience you once had.

Q8. Volunteer to help organize a school dance.

Q9. Ask a group of kids who are planning to go to a movie if you can join them.

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Q12. Keep up your side of the conversation.

Q13. Be involved in group activities.

2019 Older Group Post Camp Survey Bar Chart taking Race as factor.

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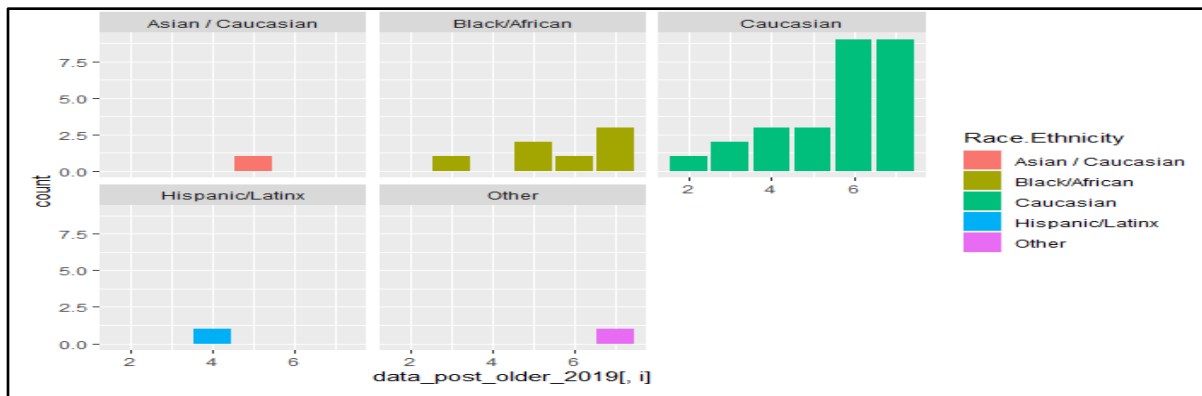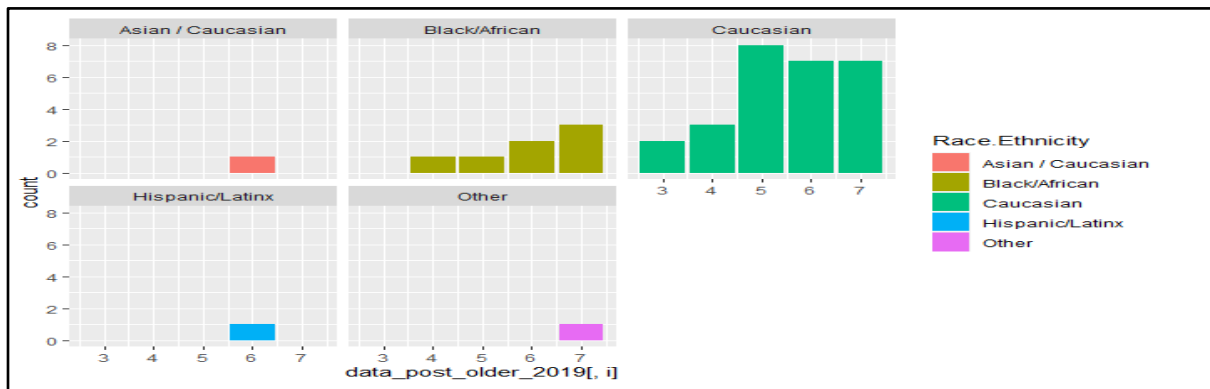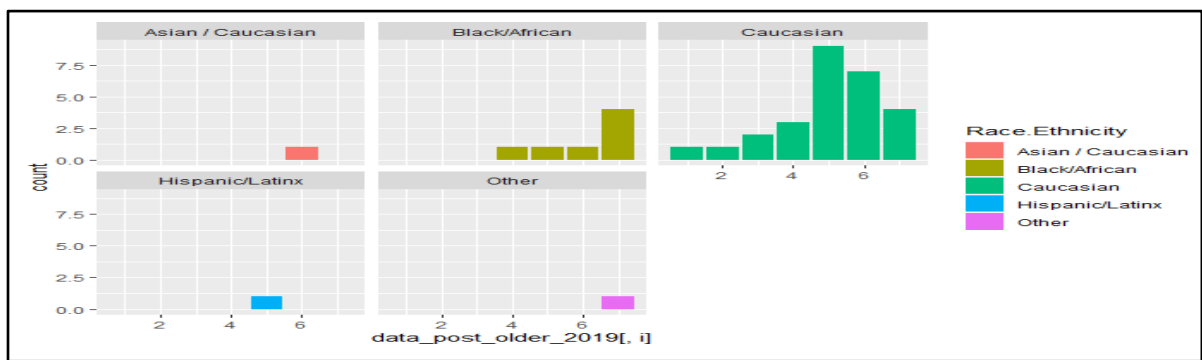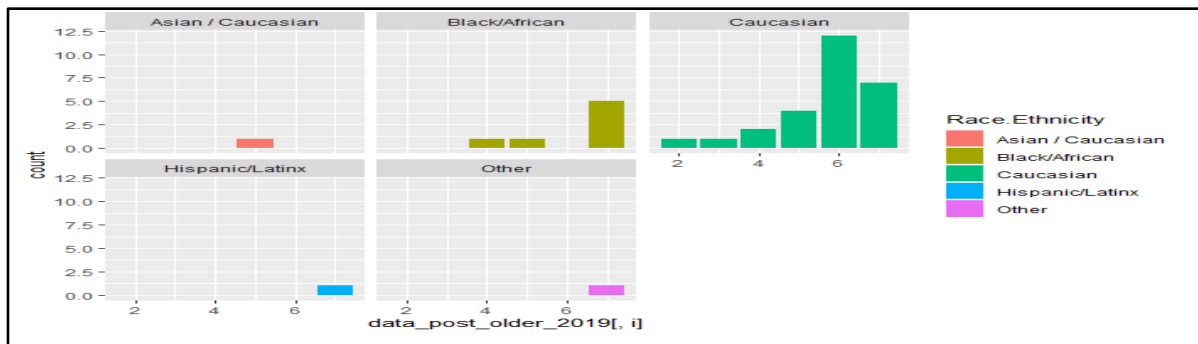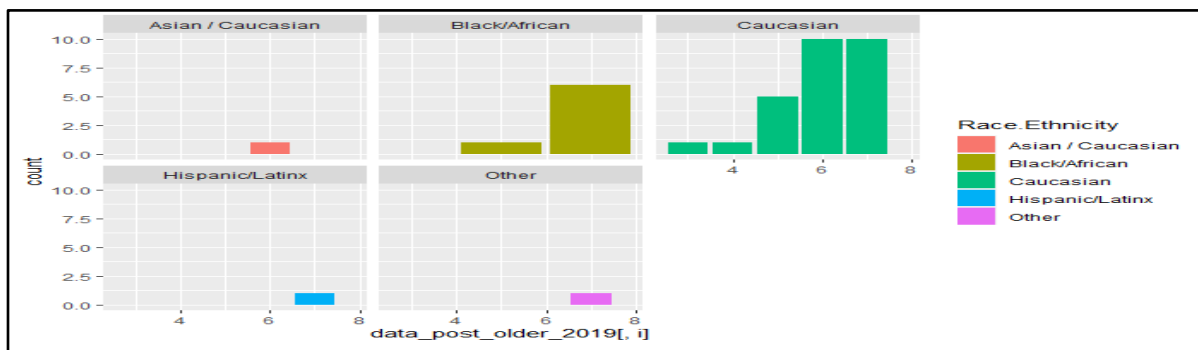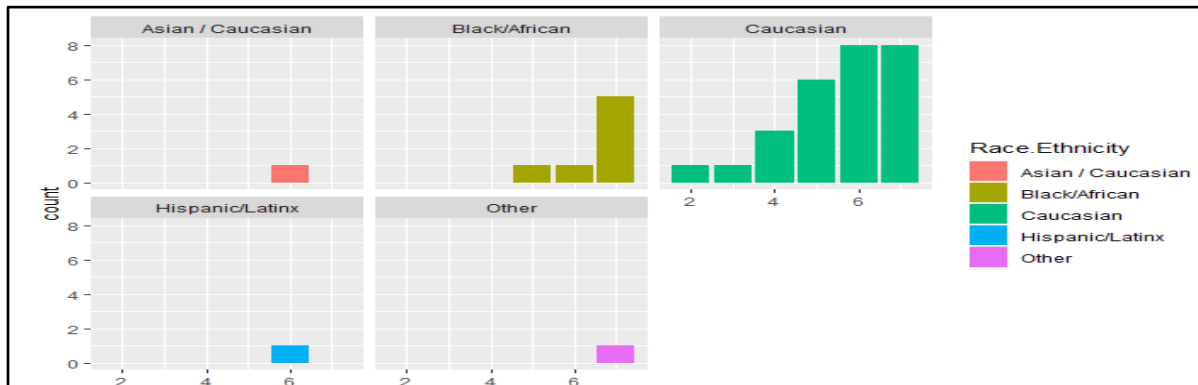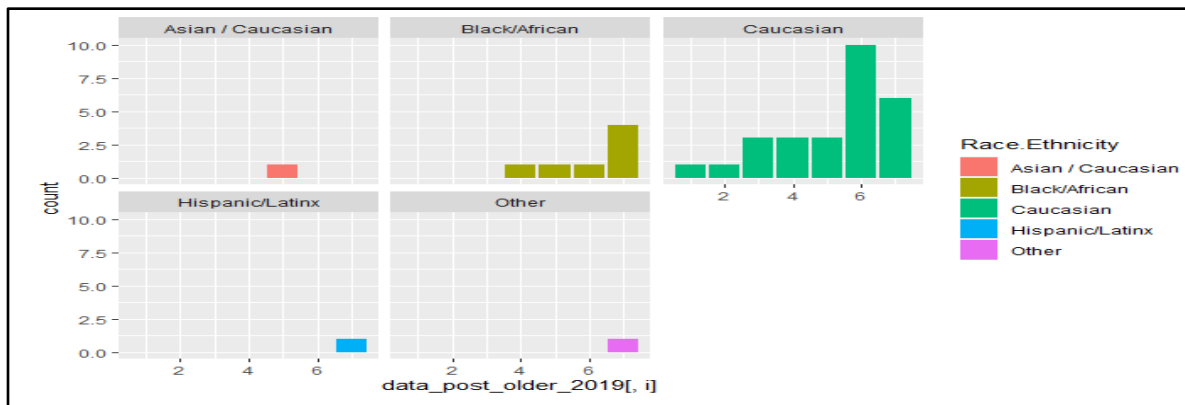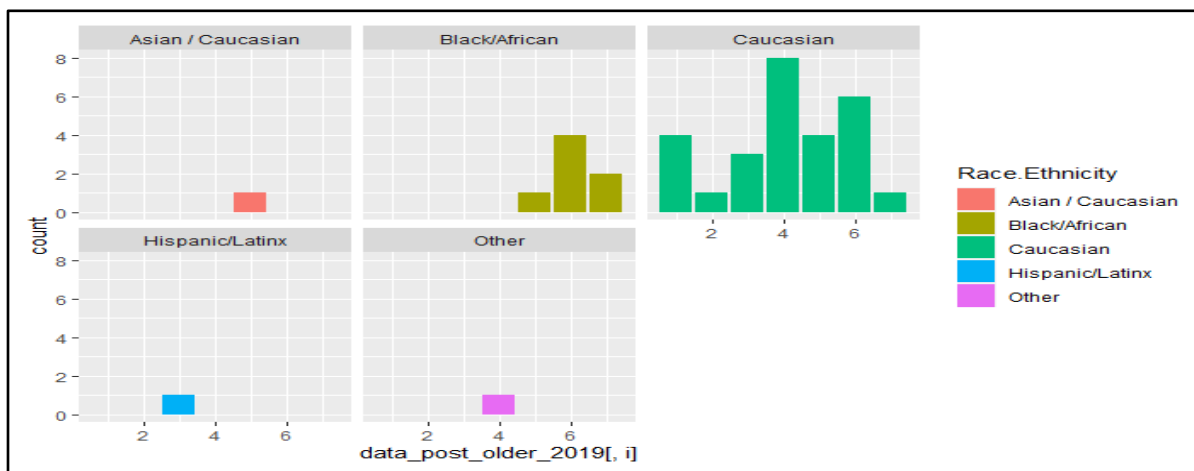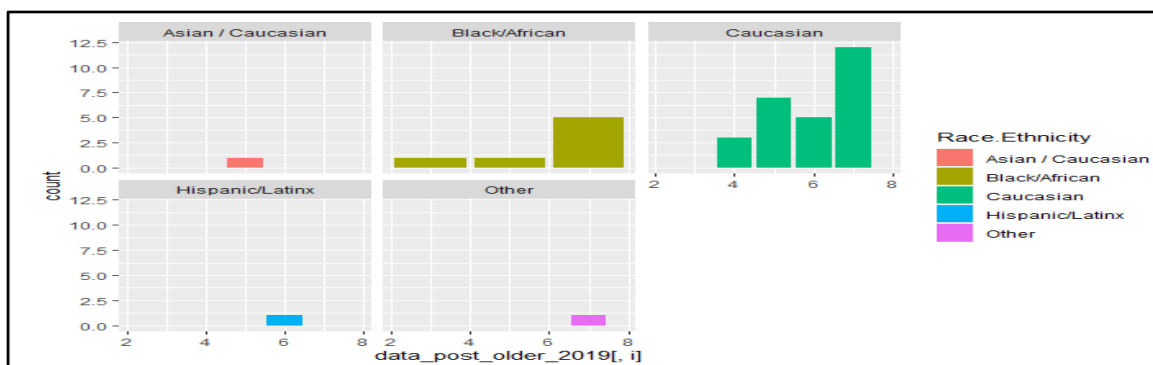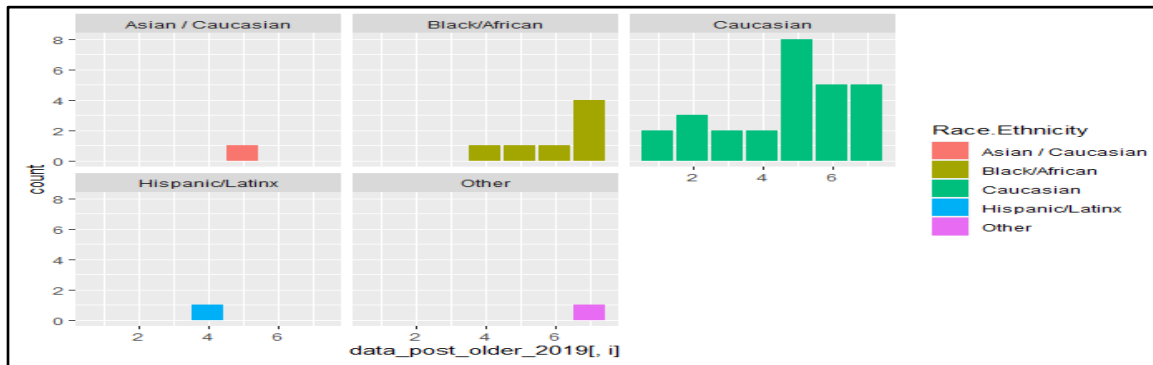
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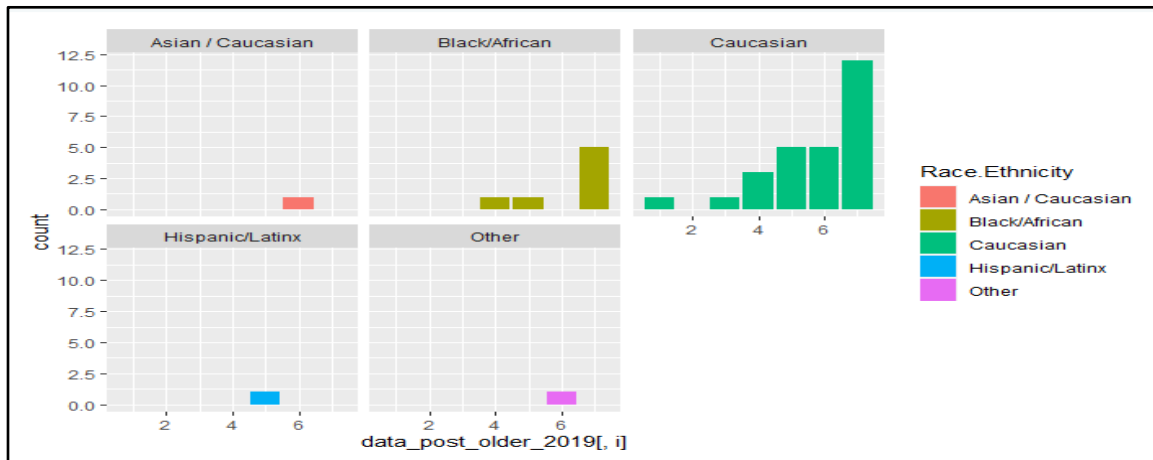
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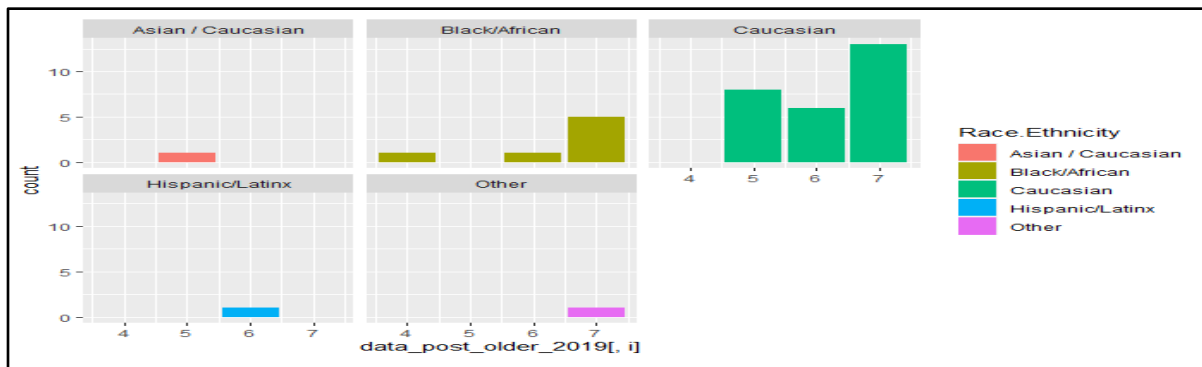
2019 Younger Group Post Camp Survey Bar Chart taking Race as

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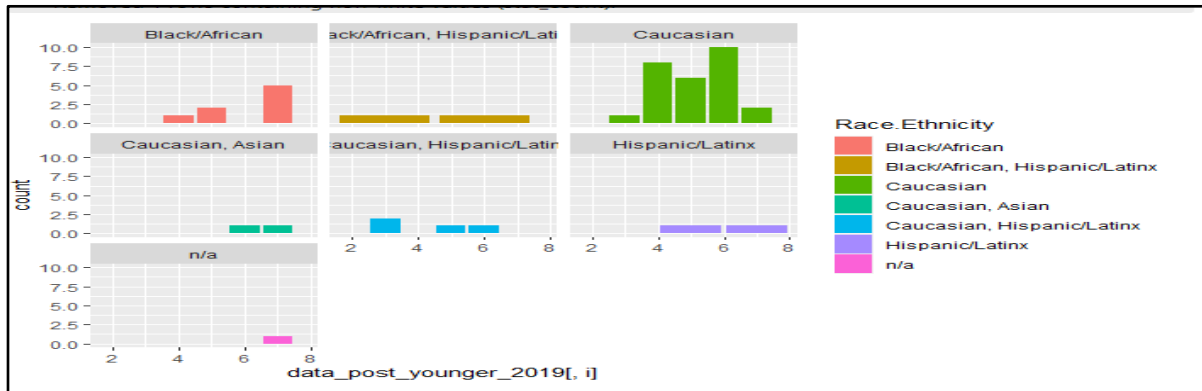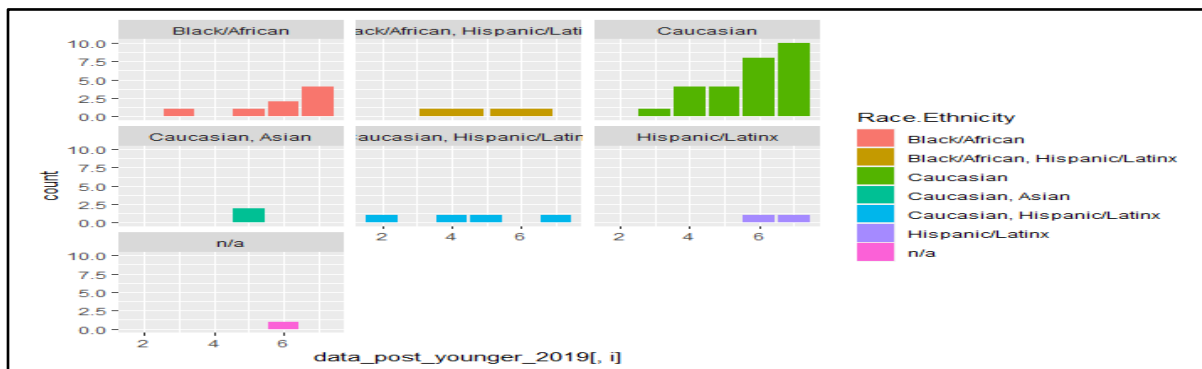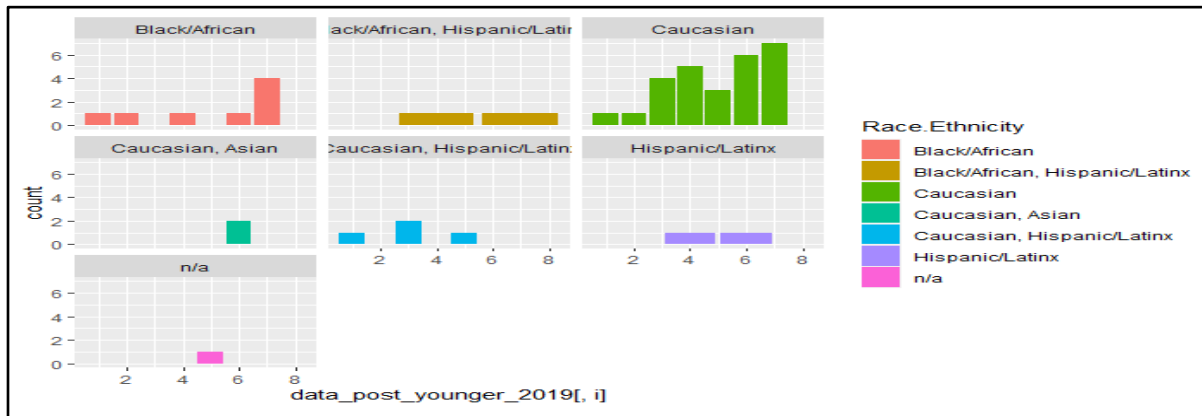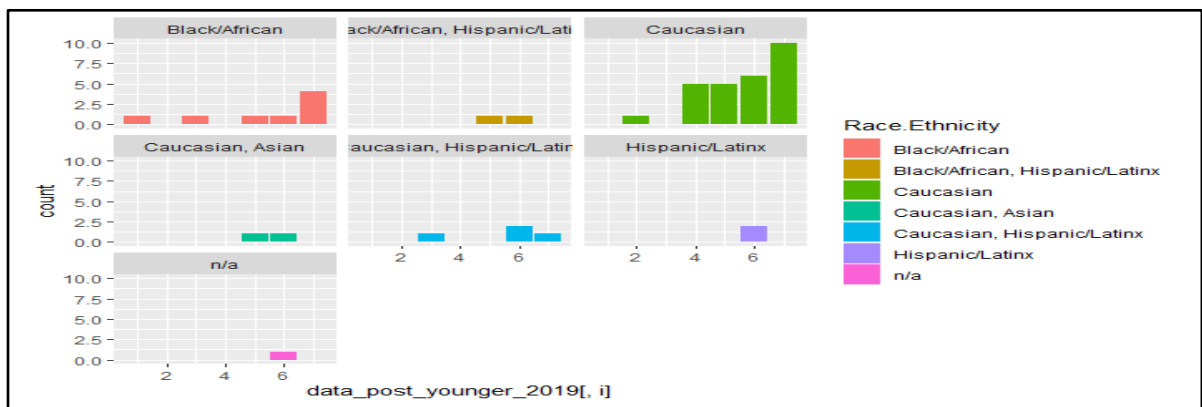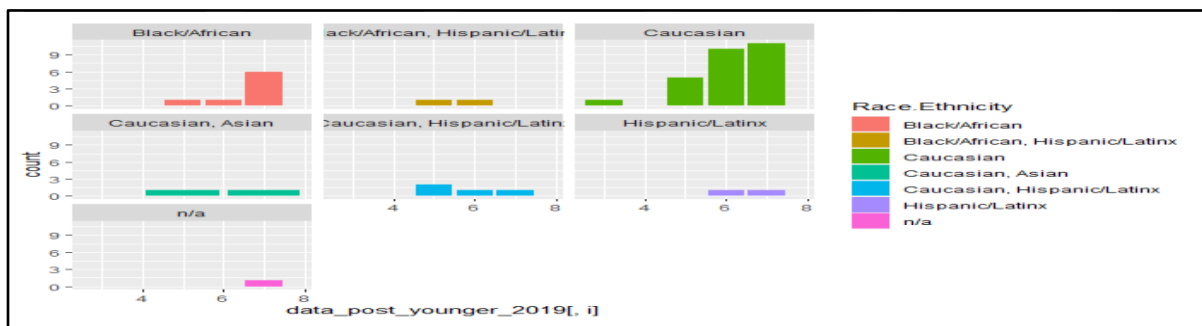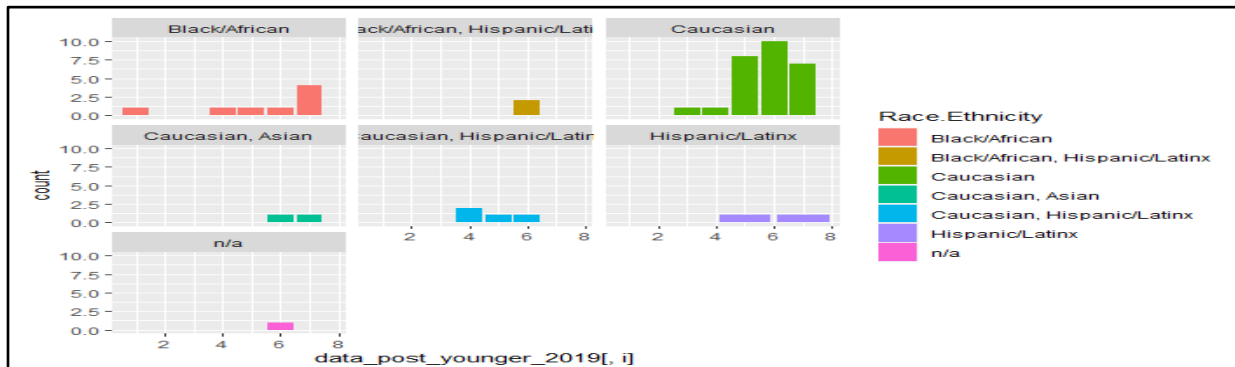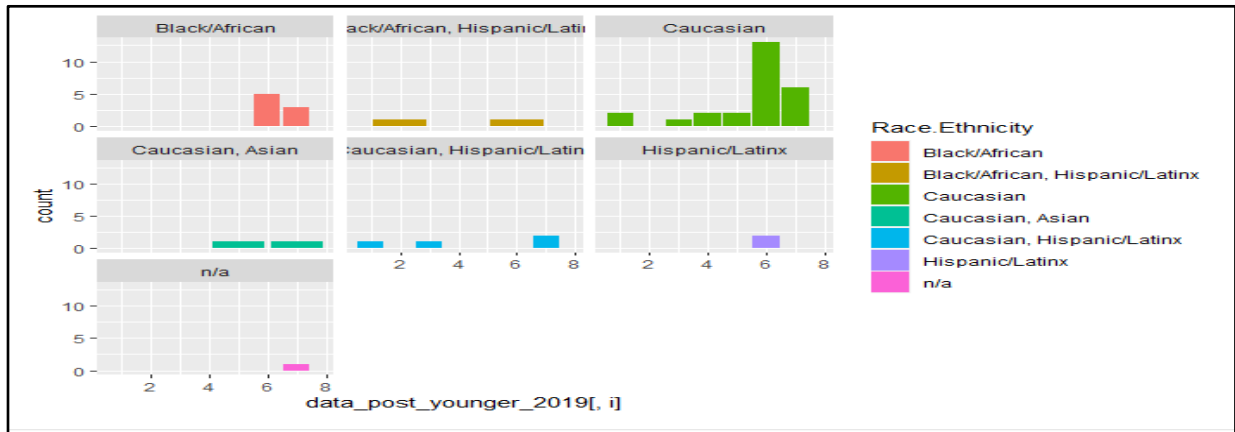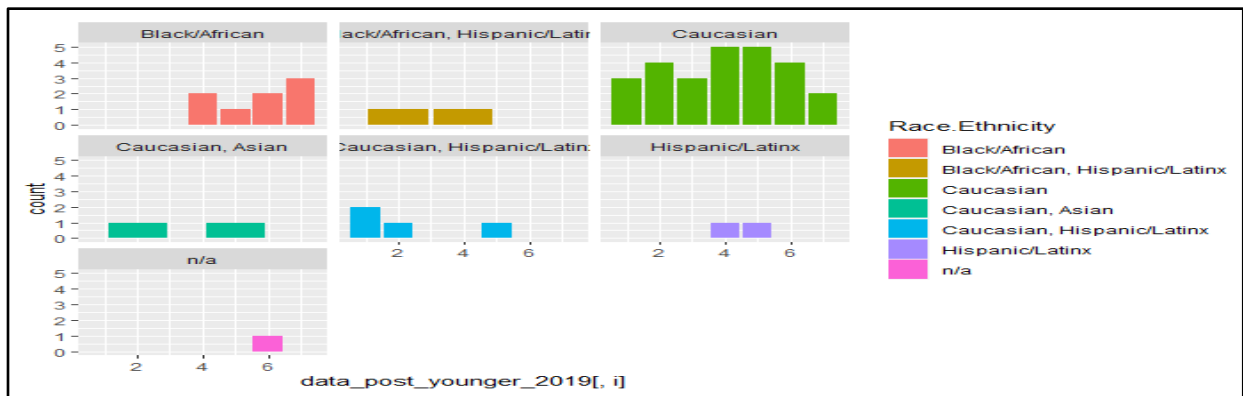
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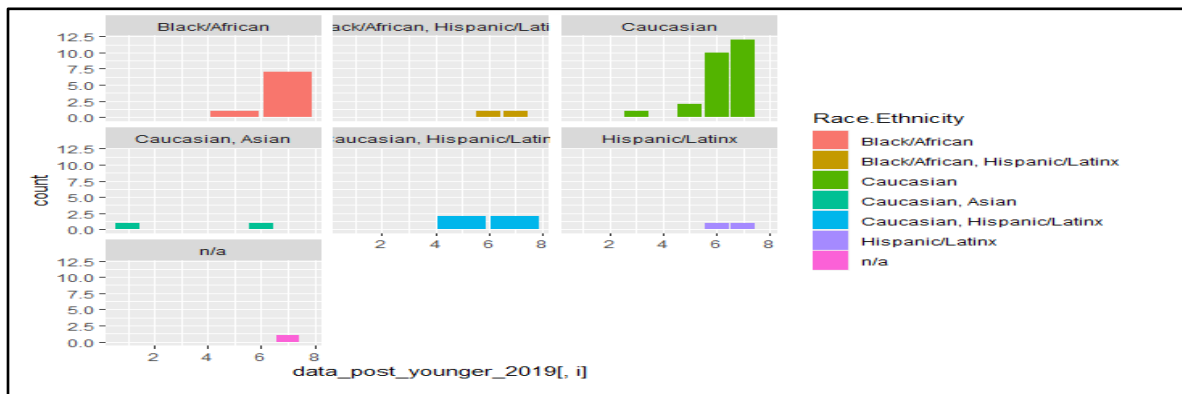
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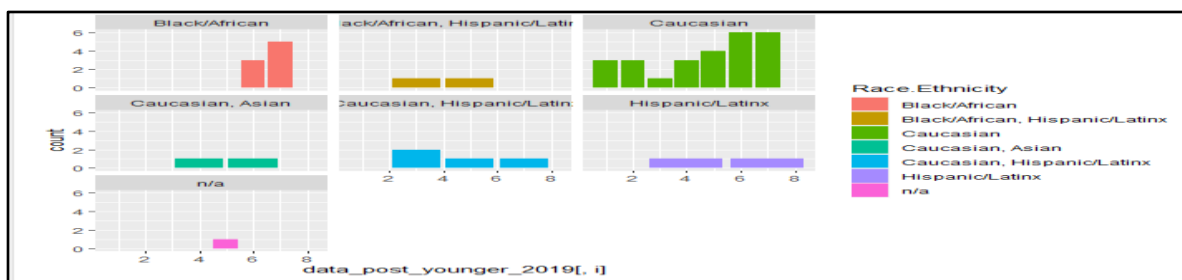
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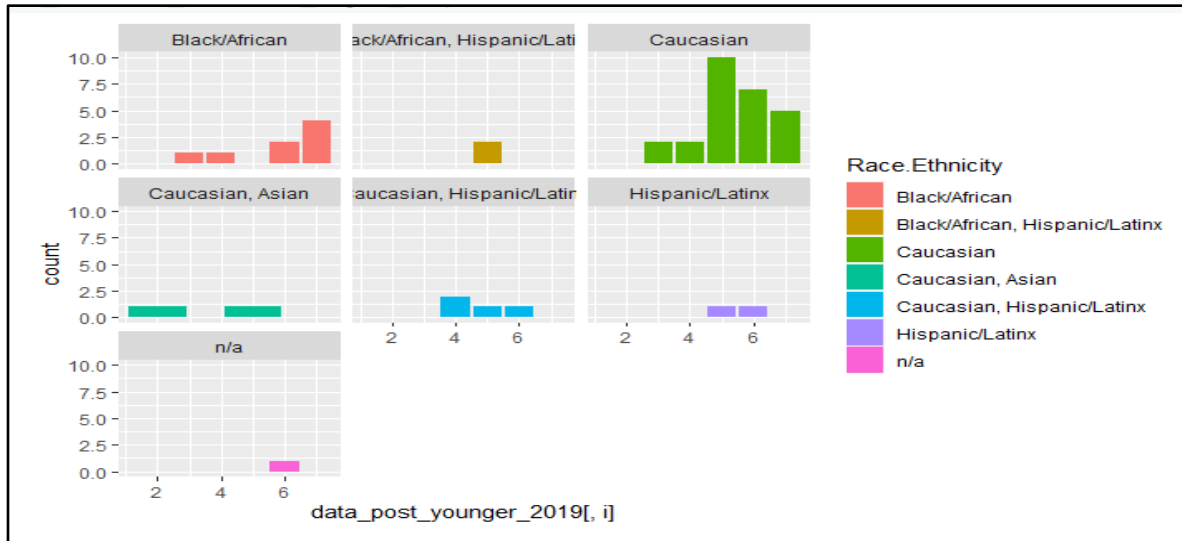
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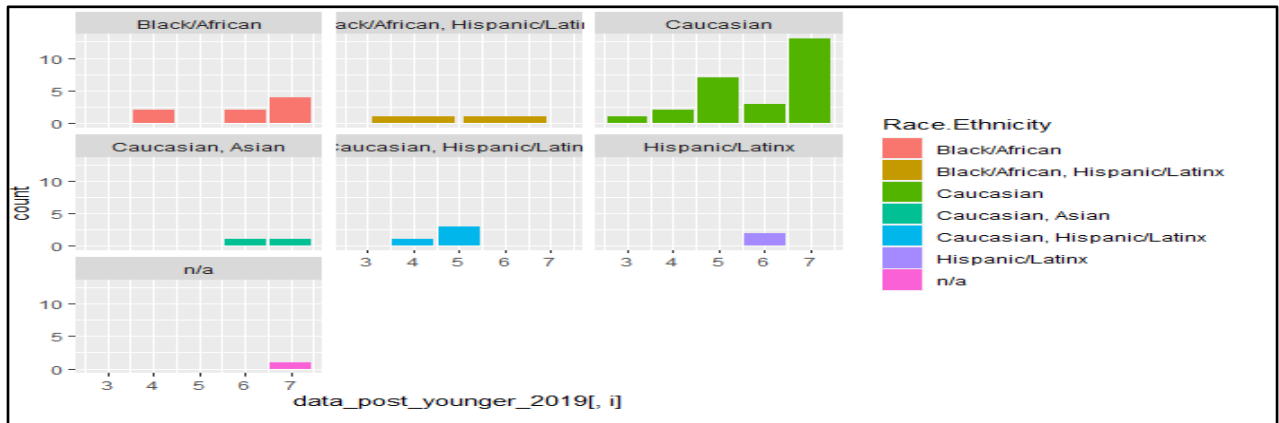
2018_Older post camp survey Age is factor

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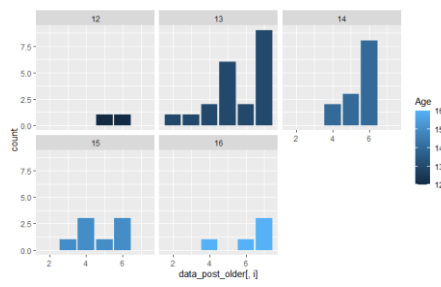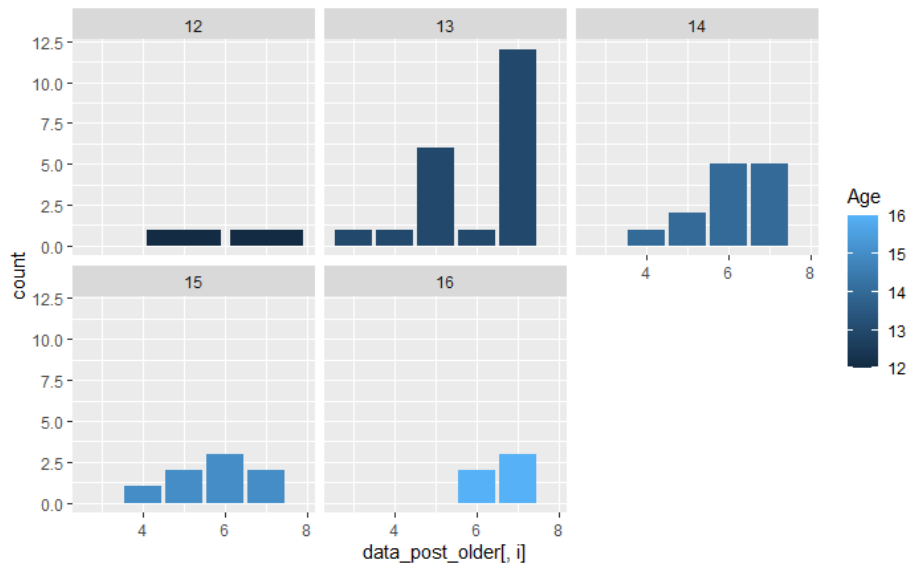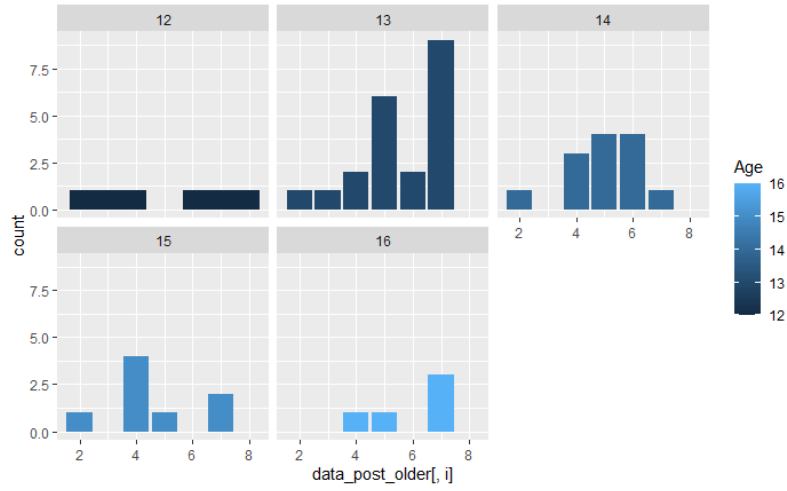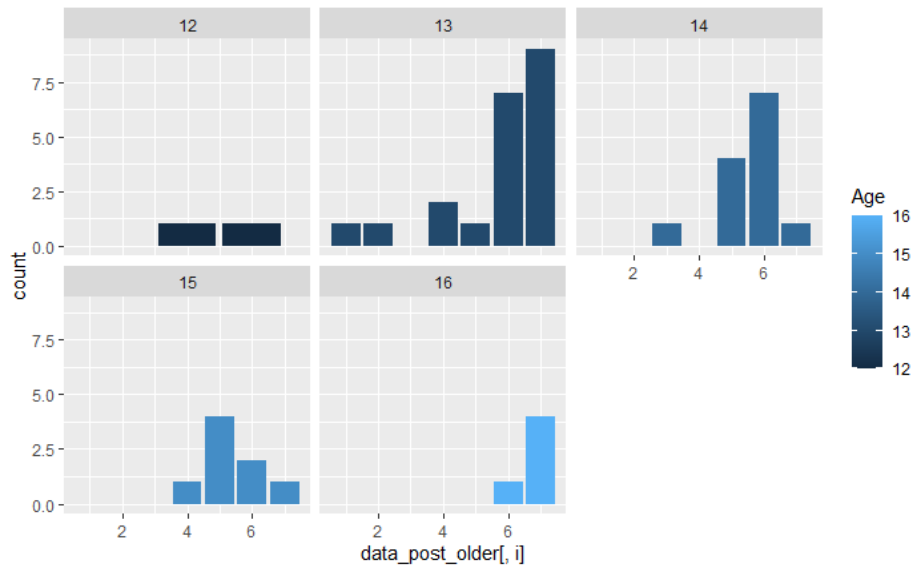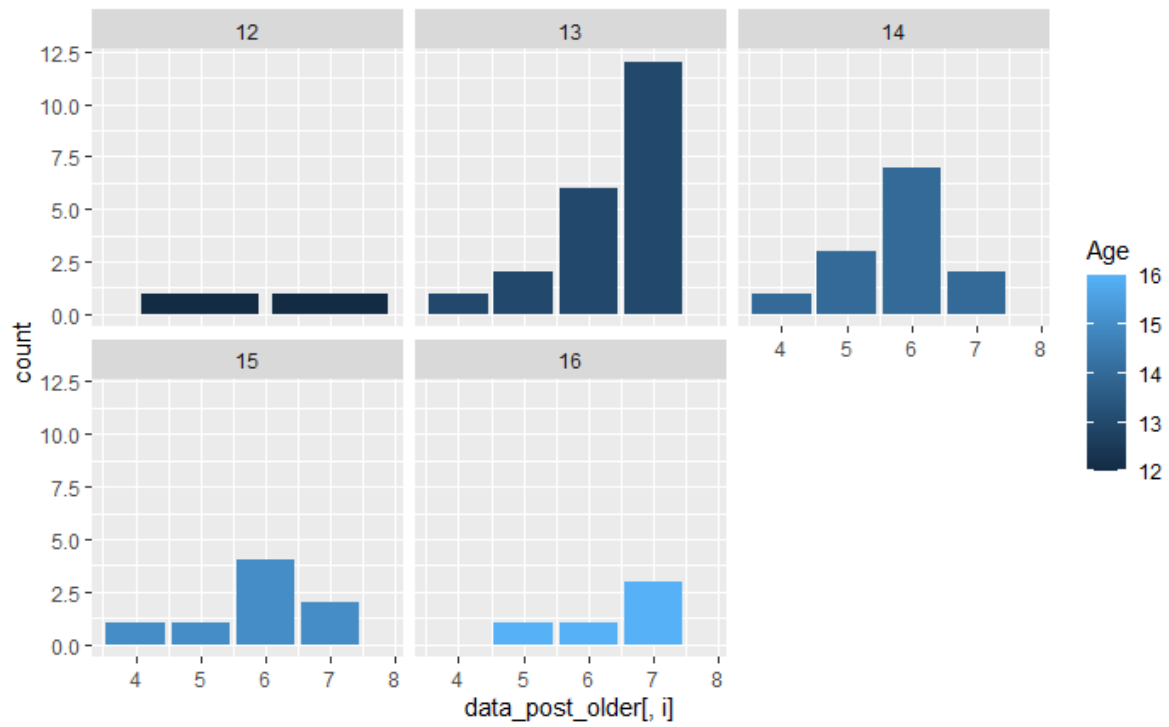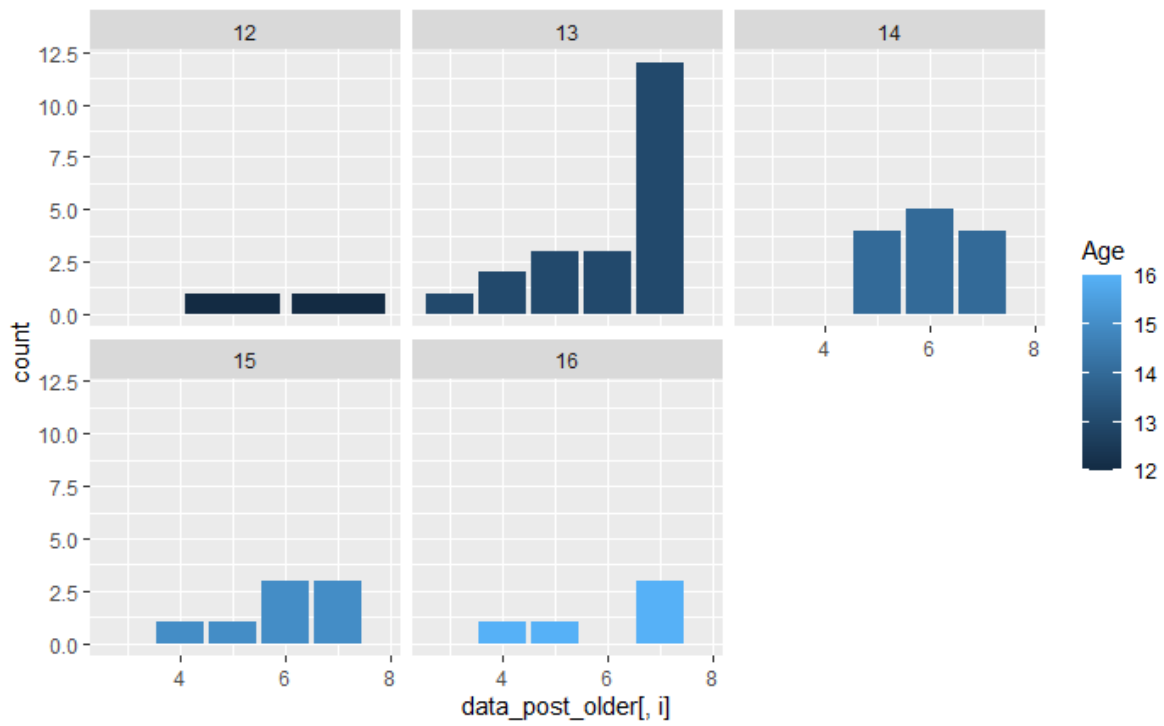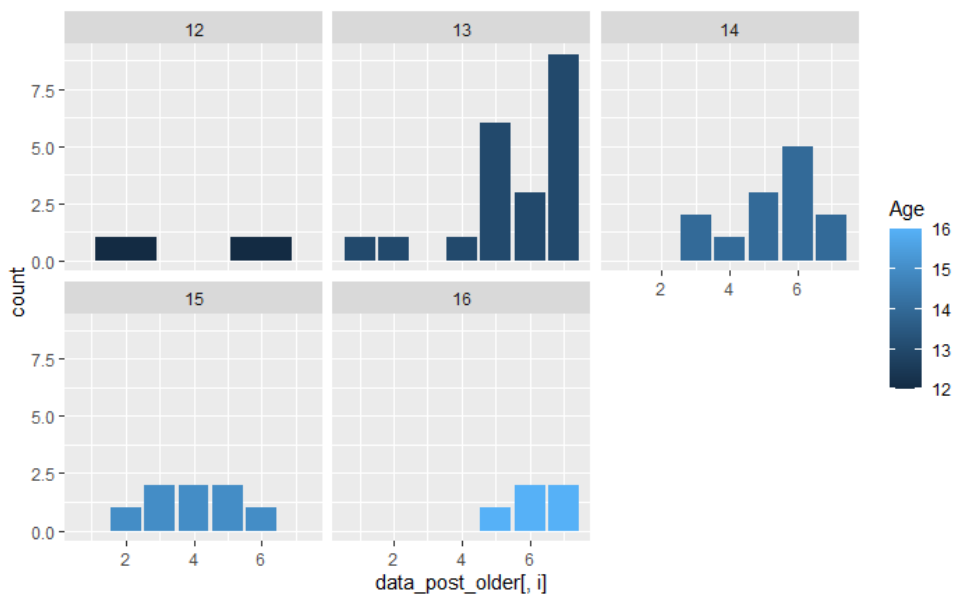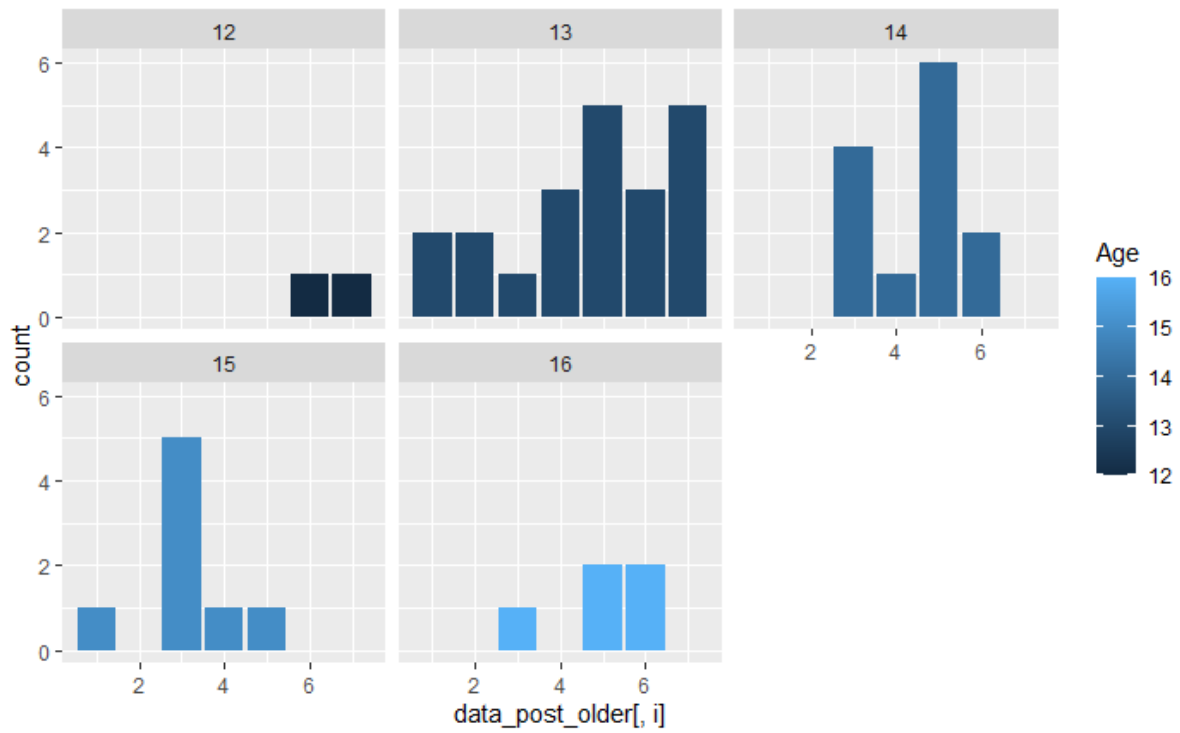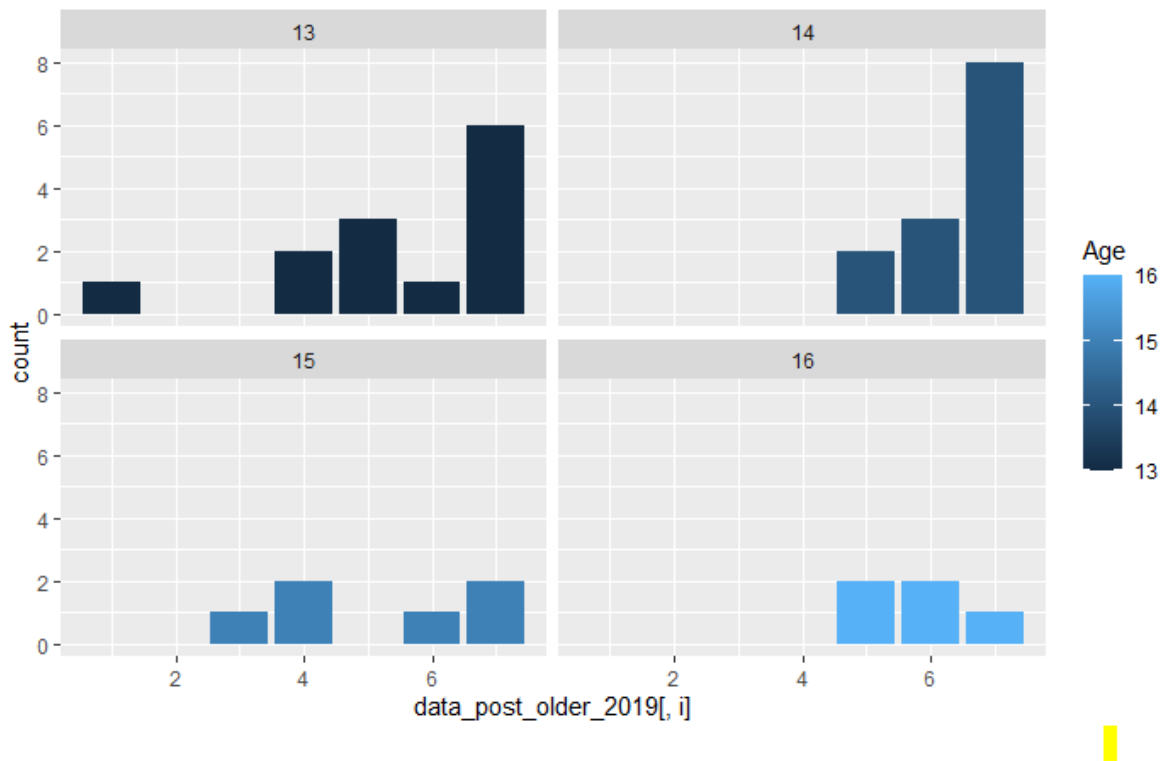

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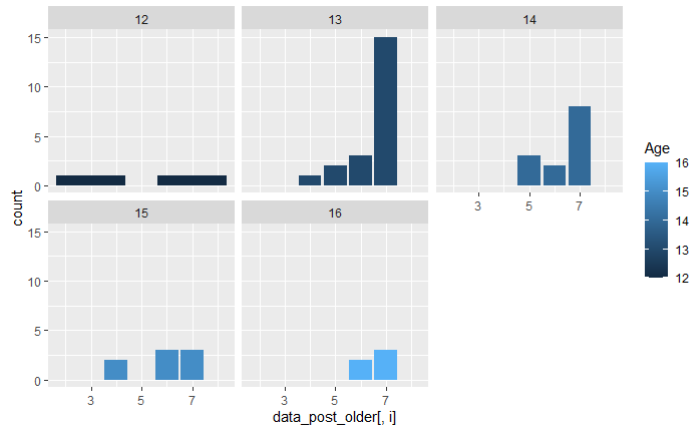
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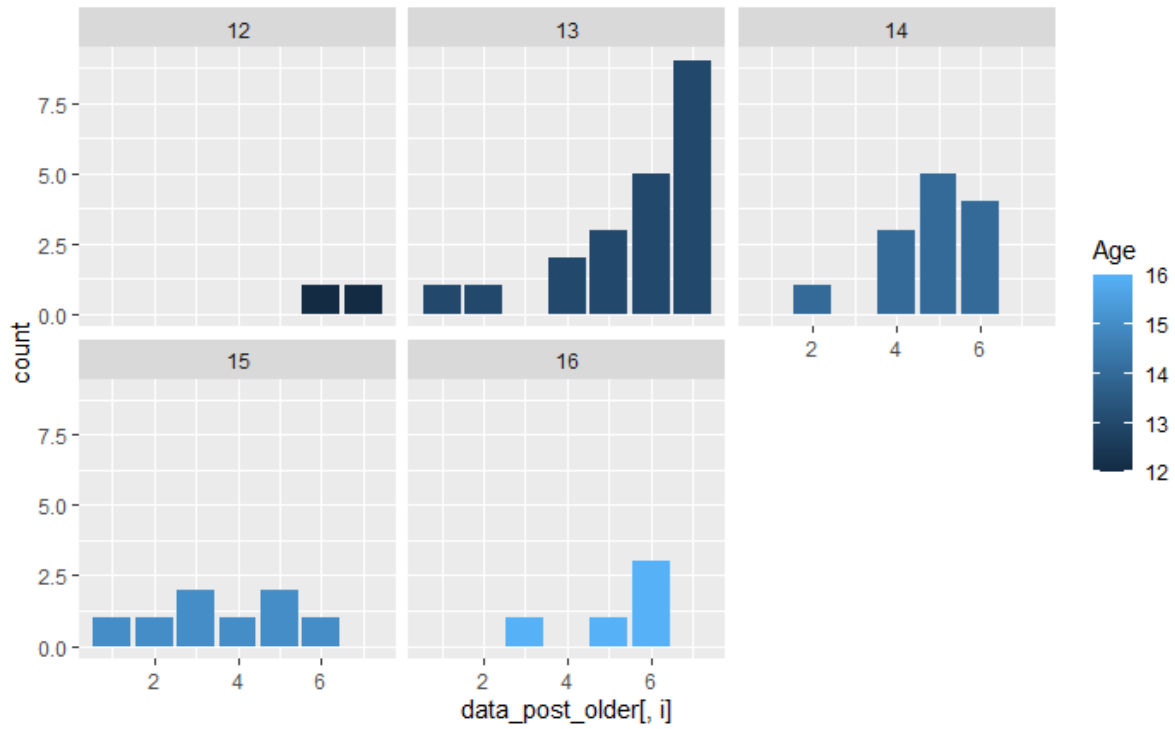
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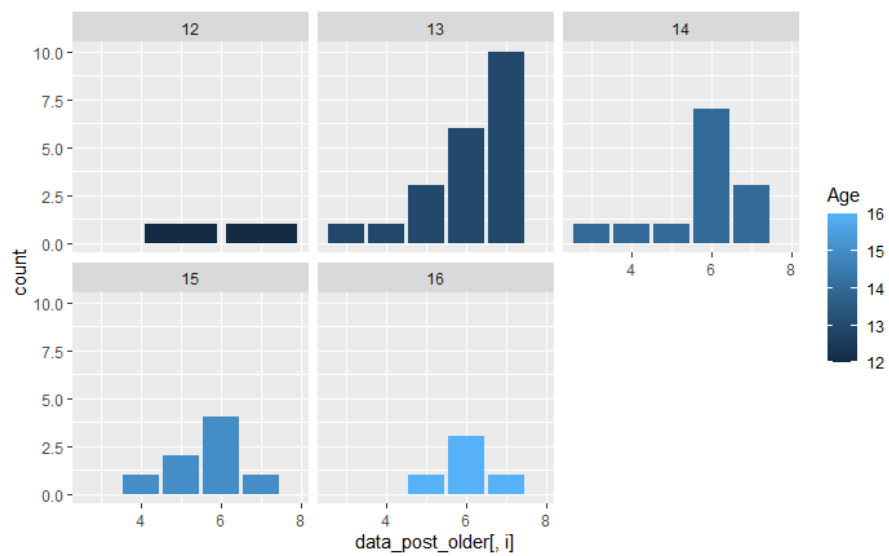
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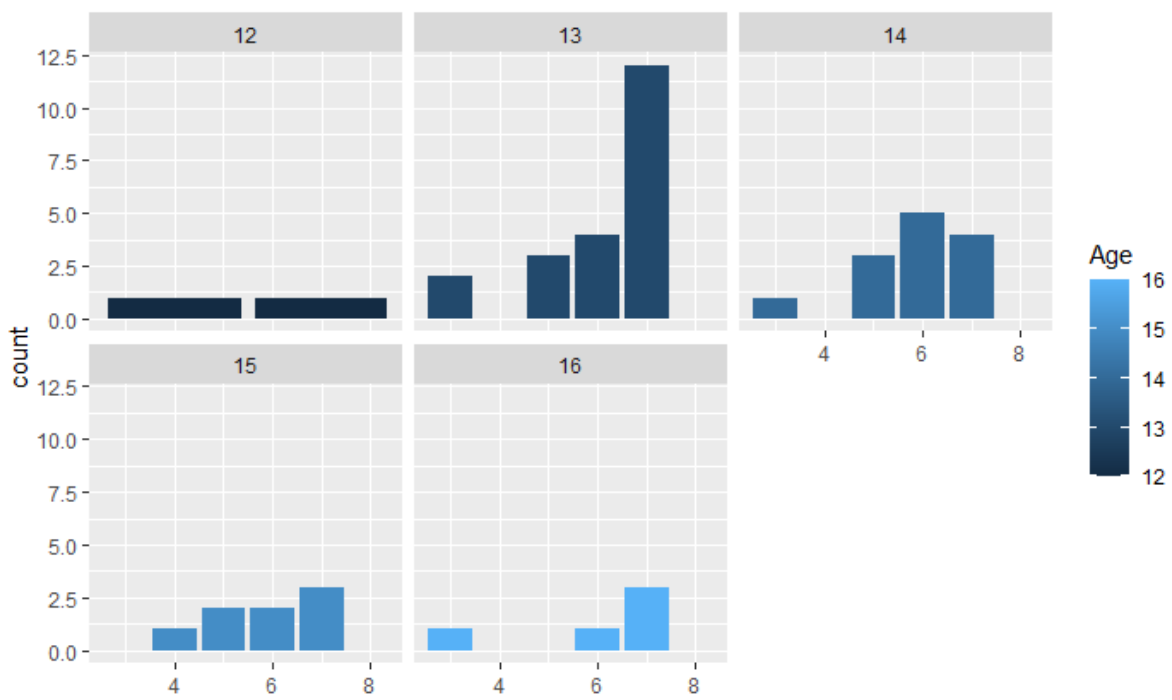
2018_Younger post camp survey Age is factor

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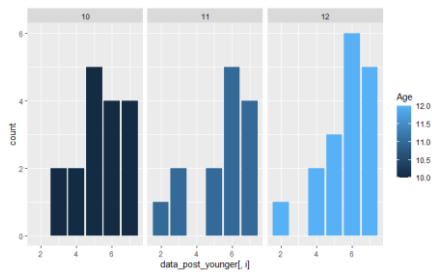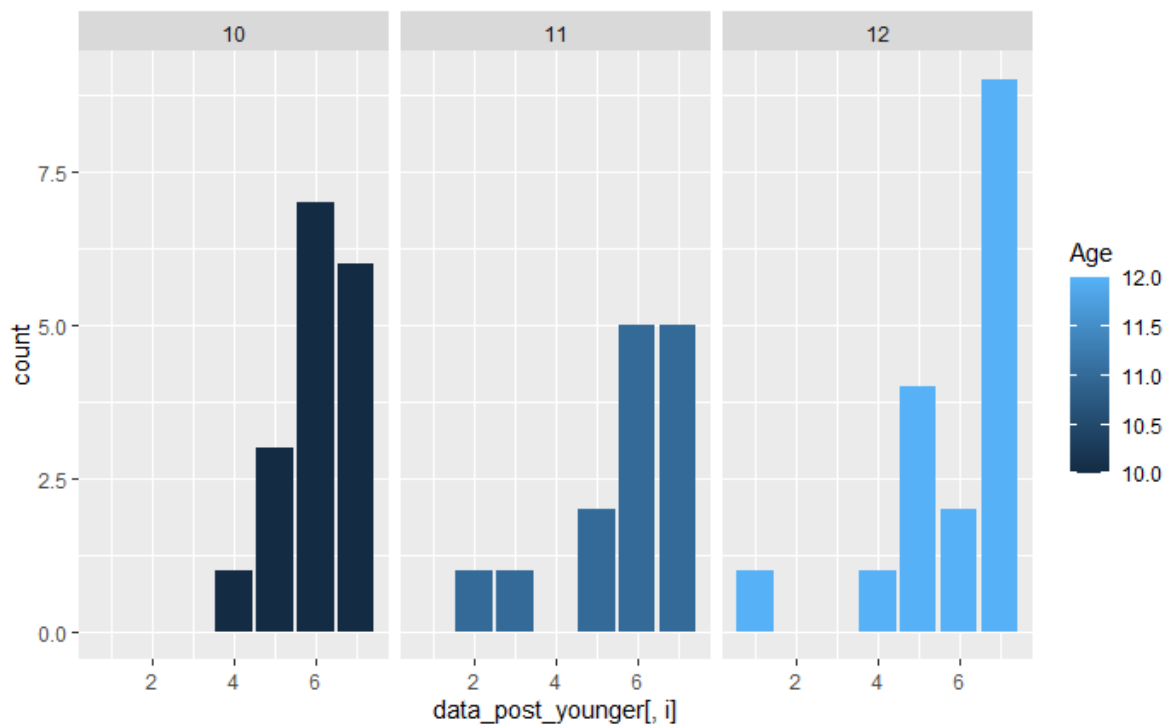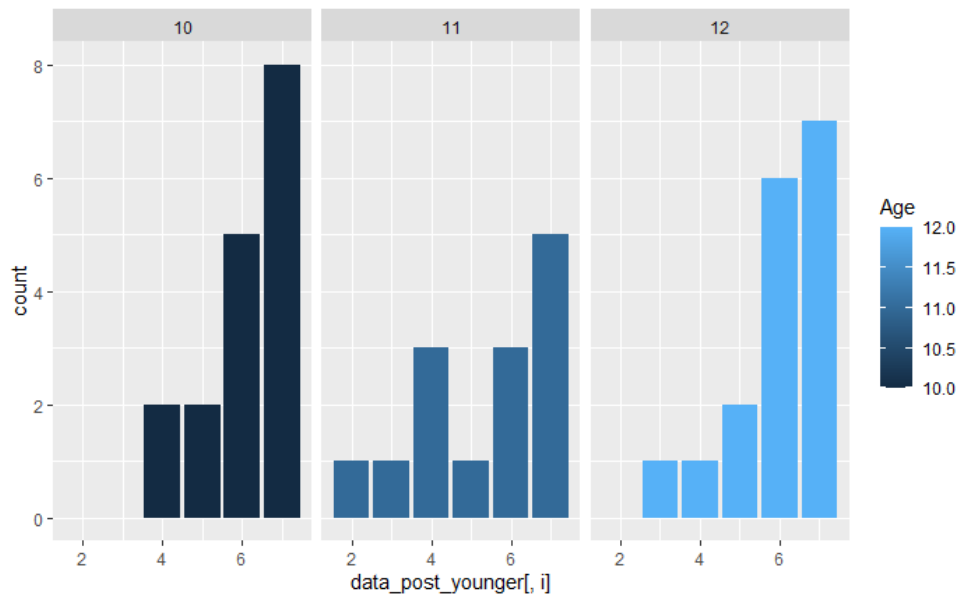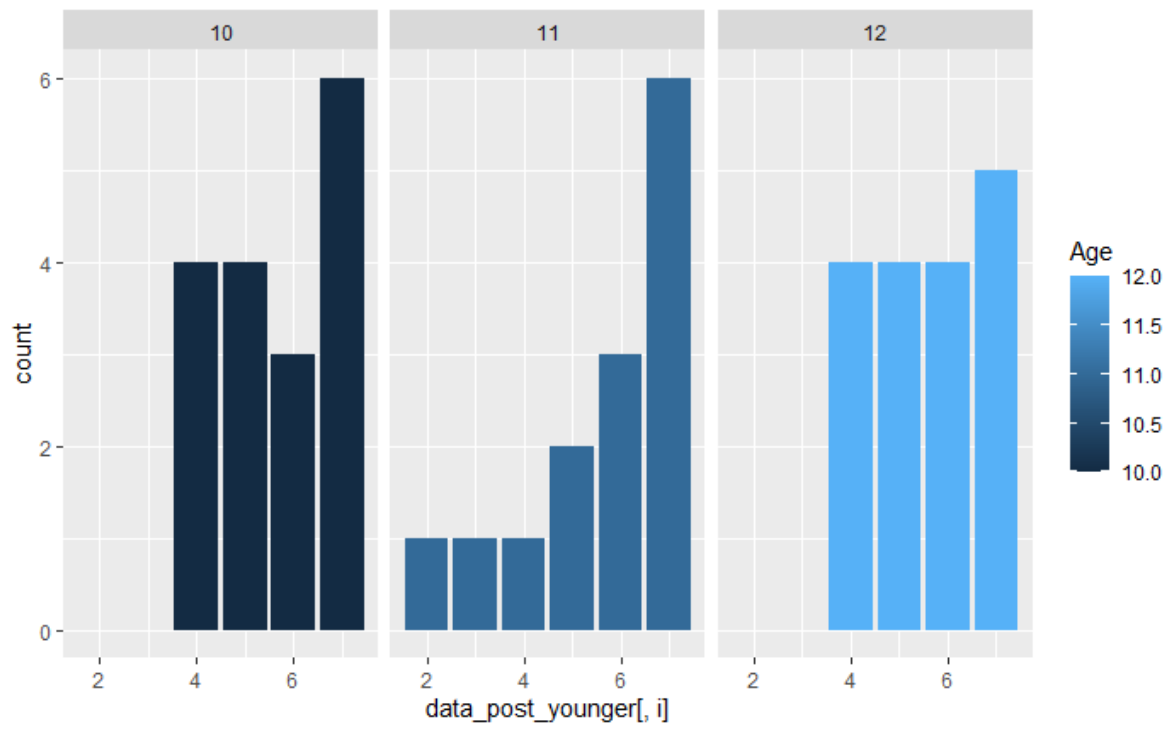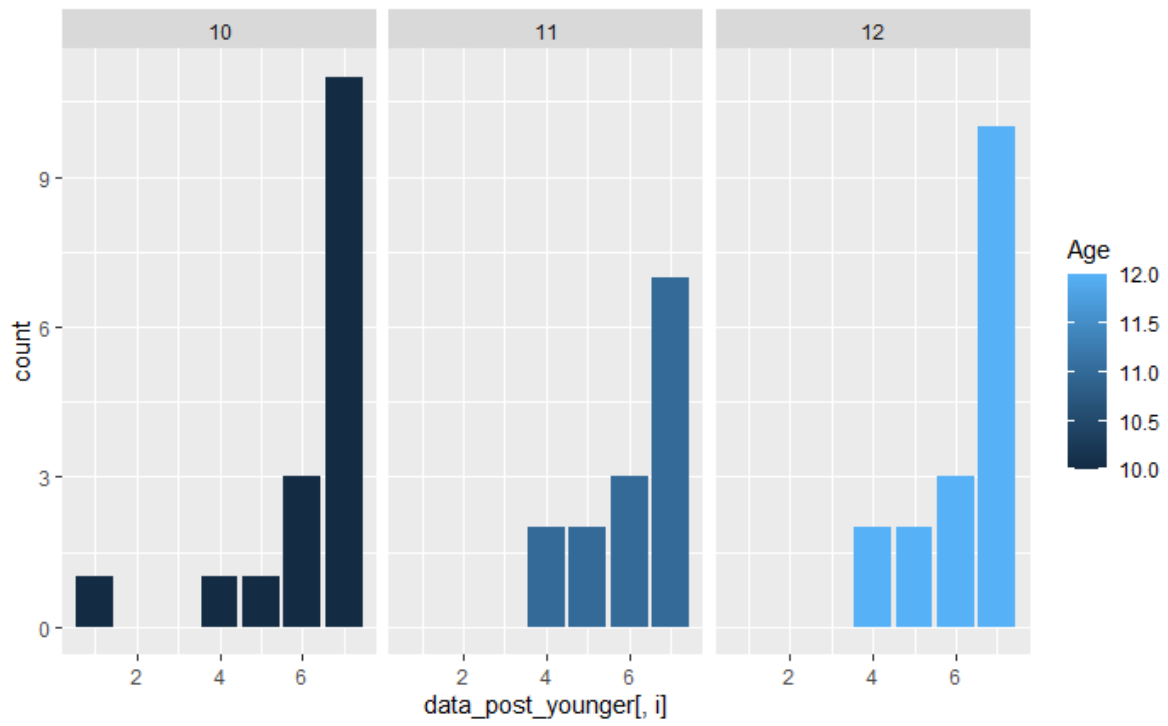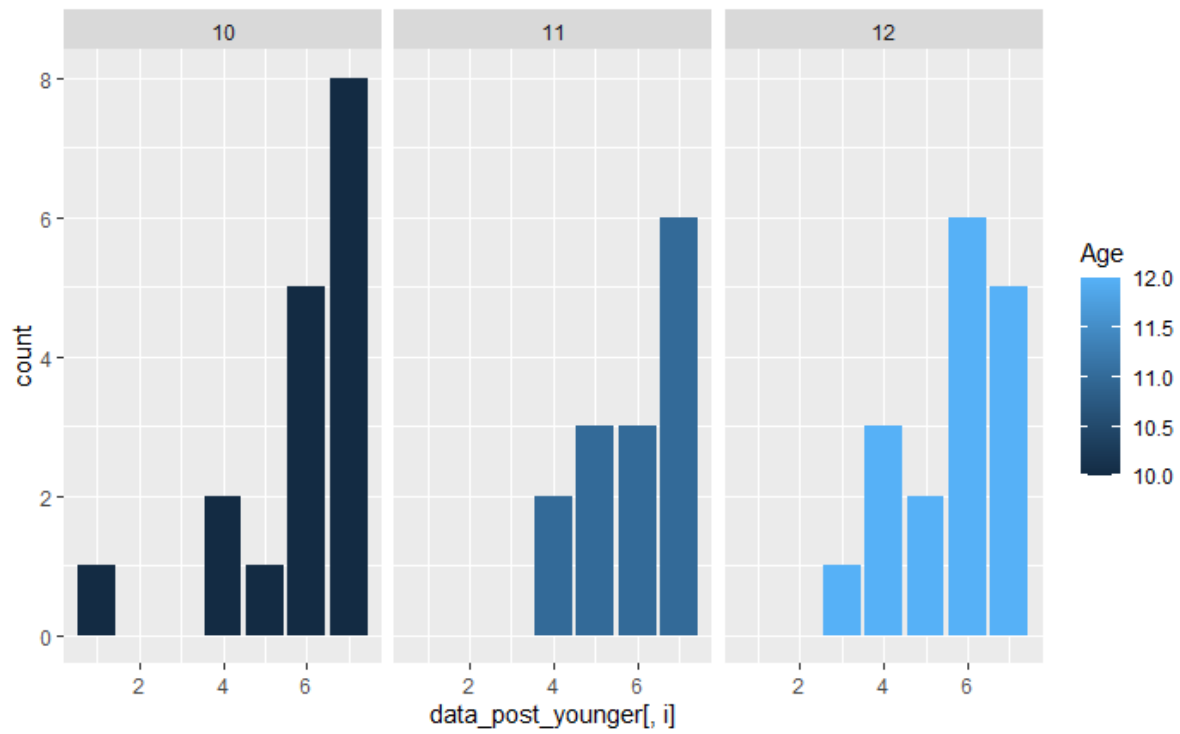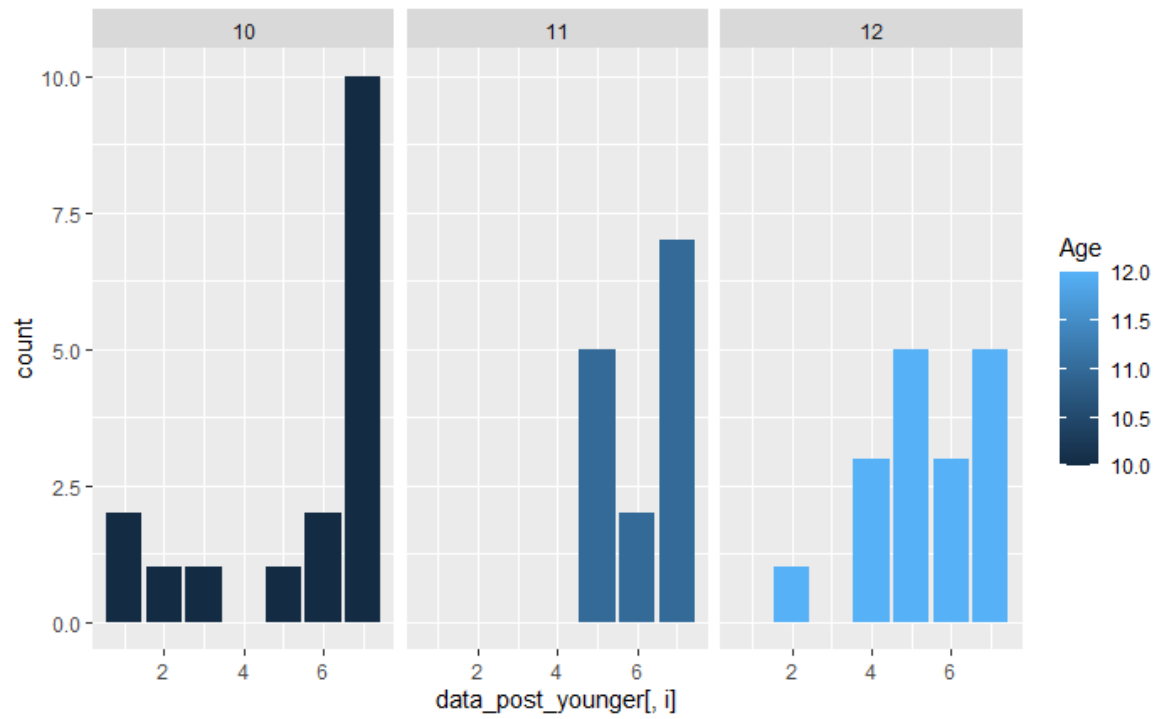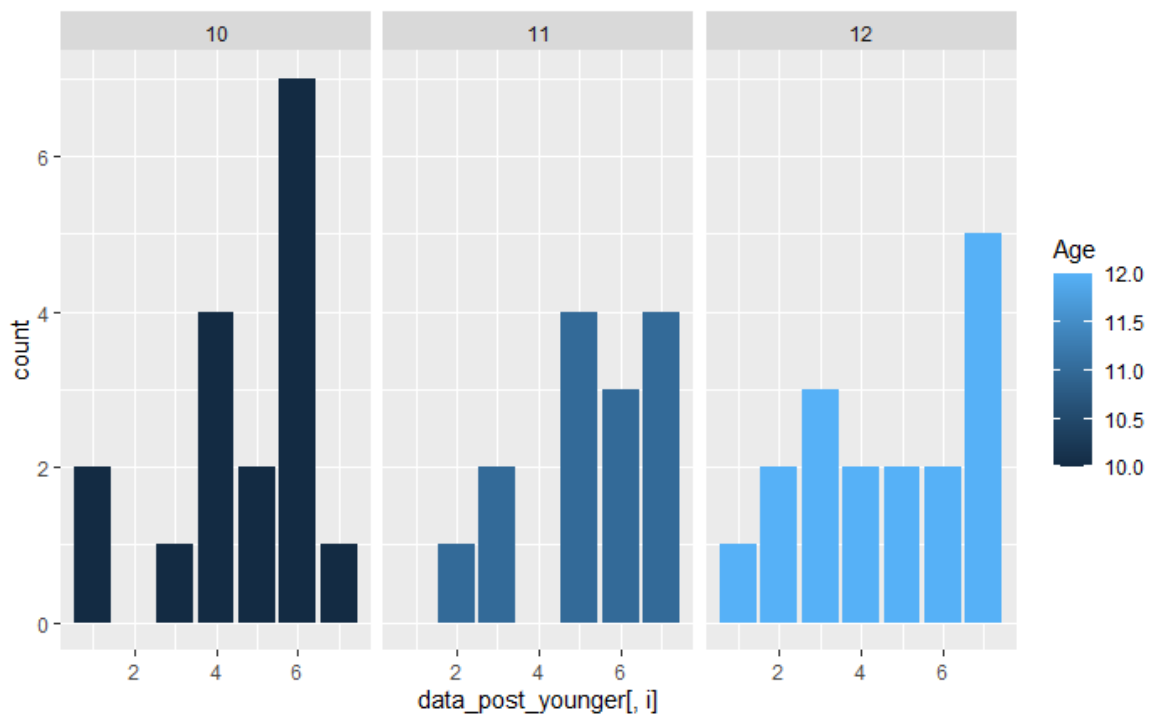
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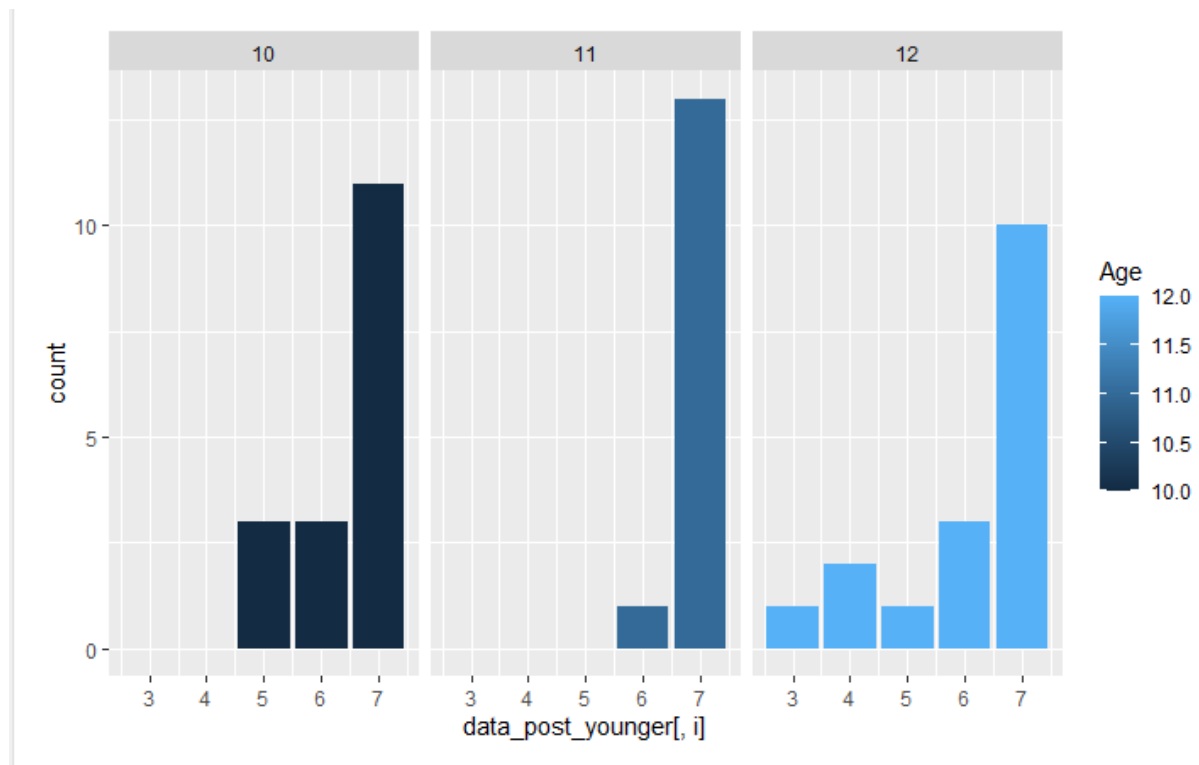
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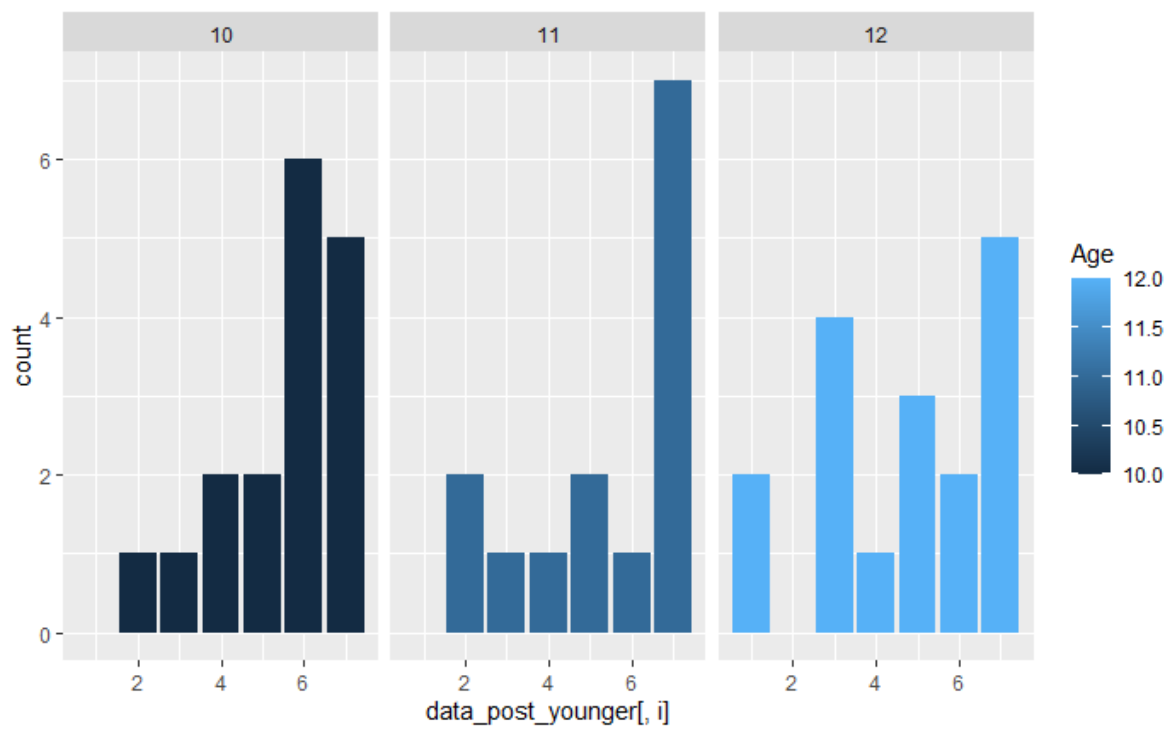
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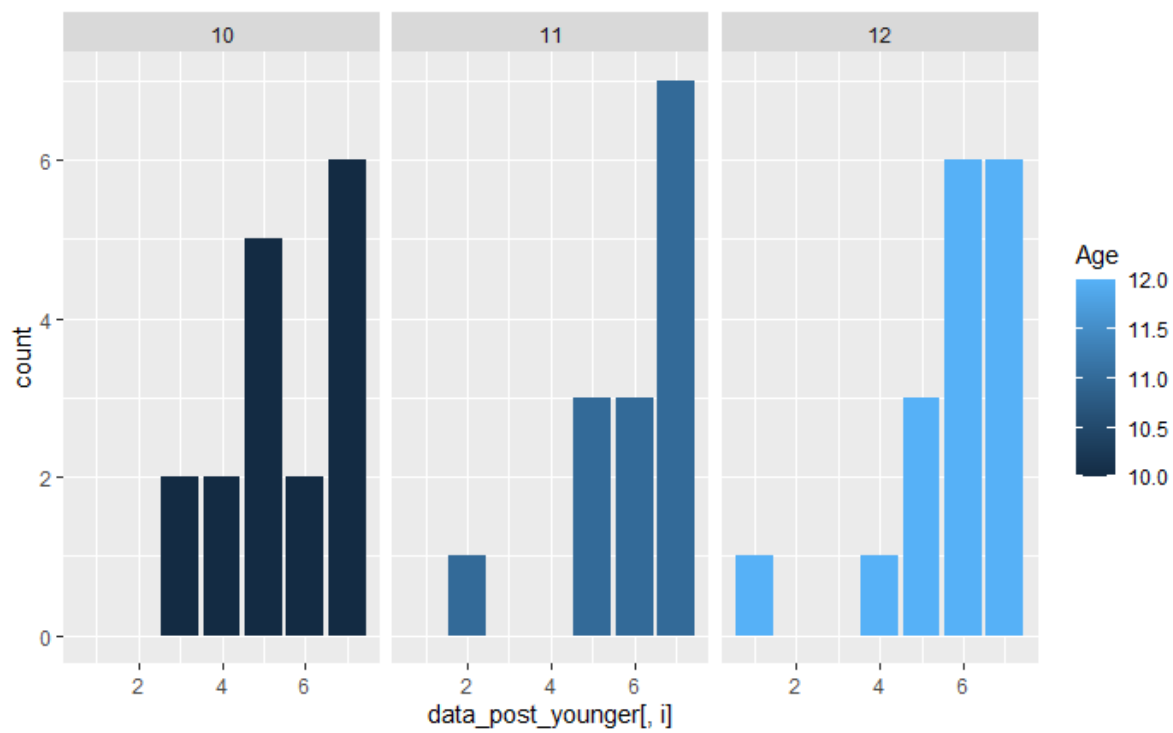
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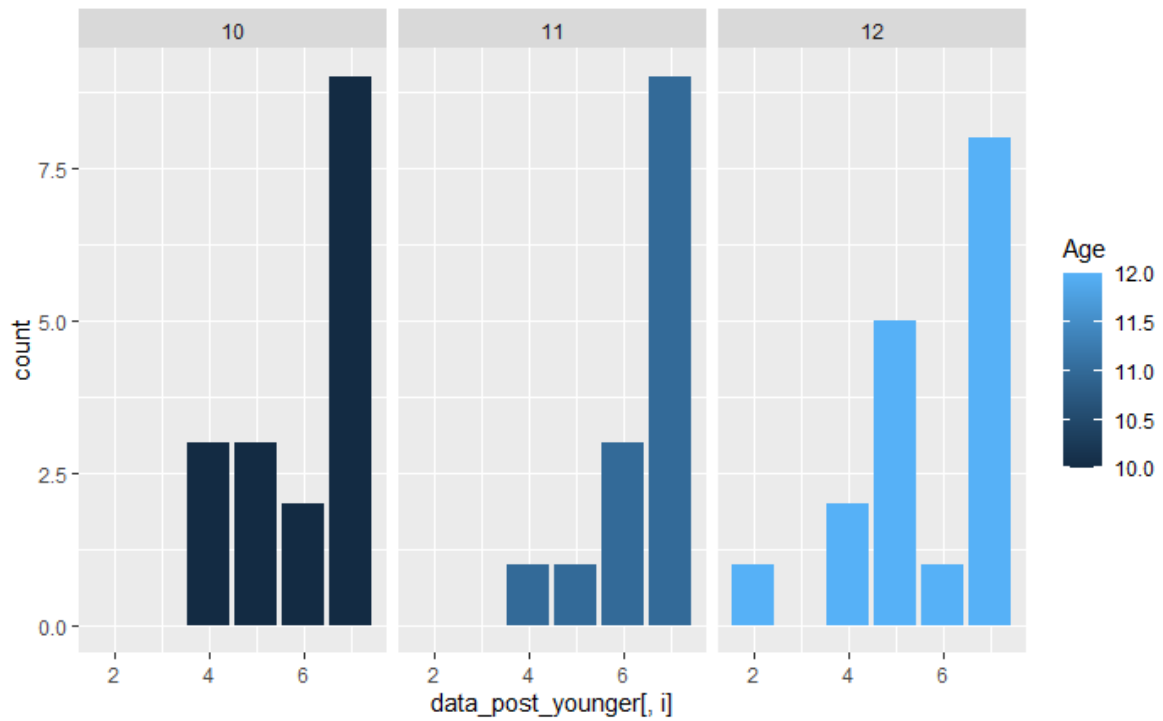
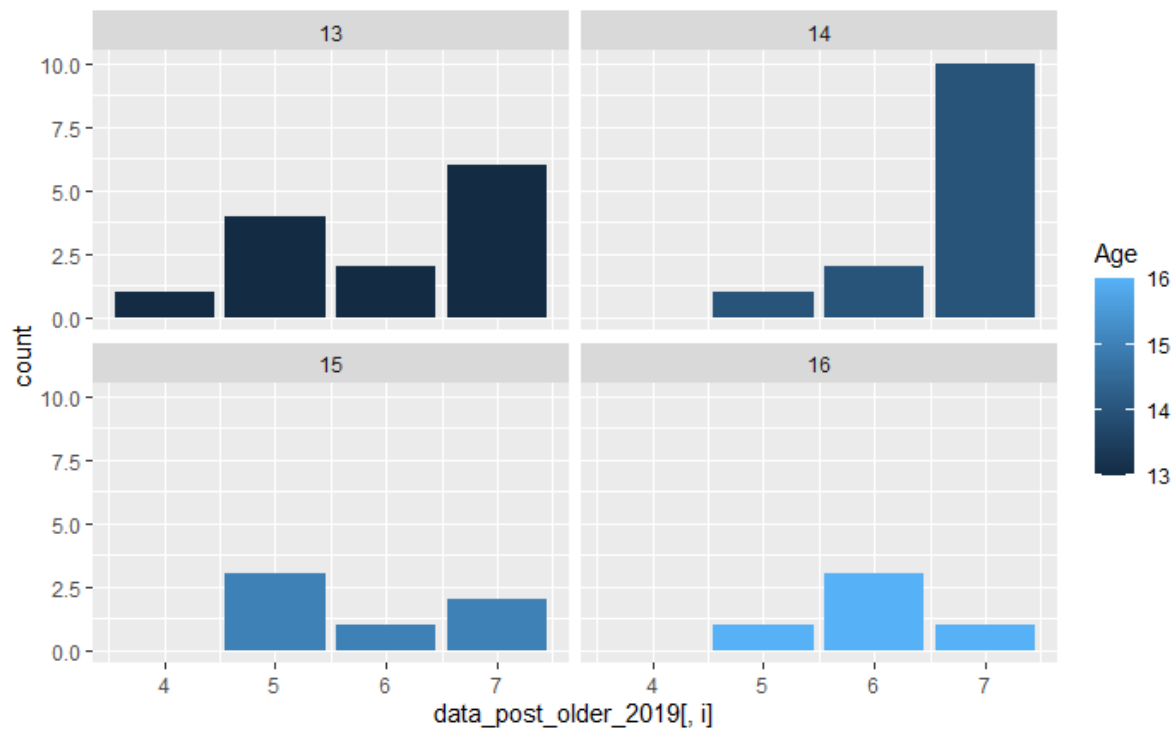2019_Older post camp survey Age is factor
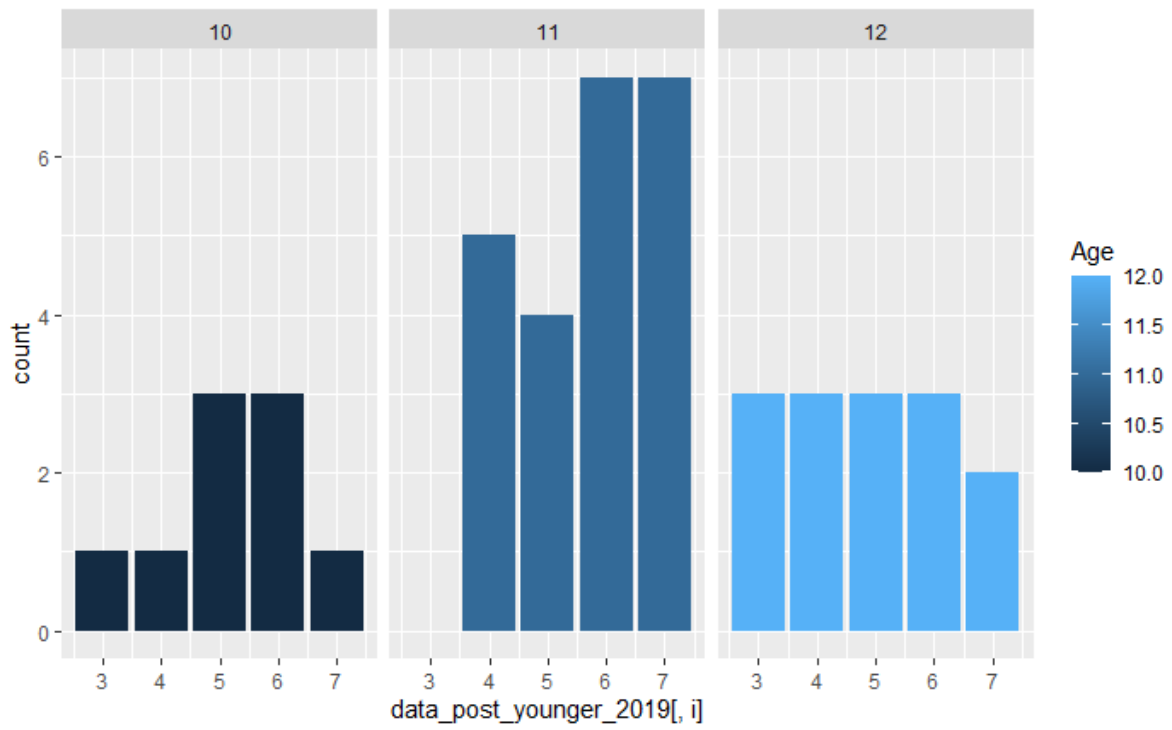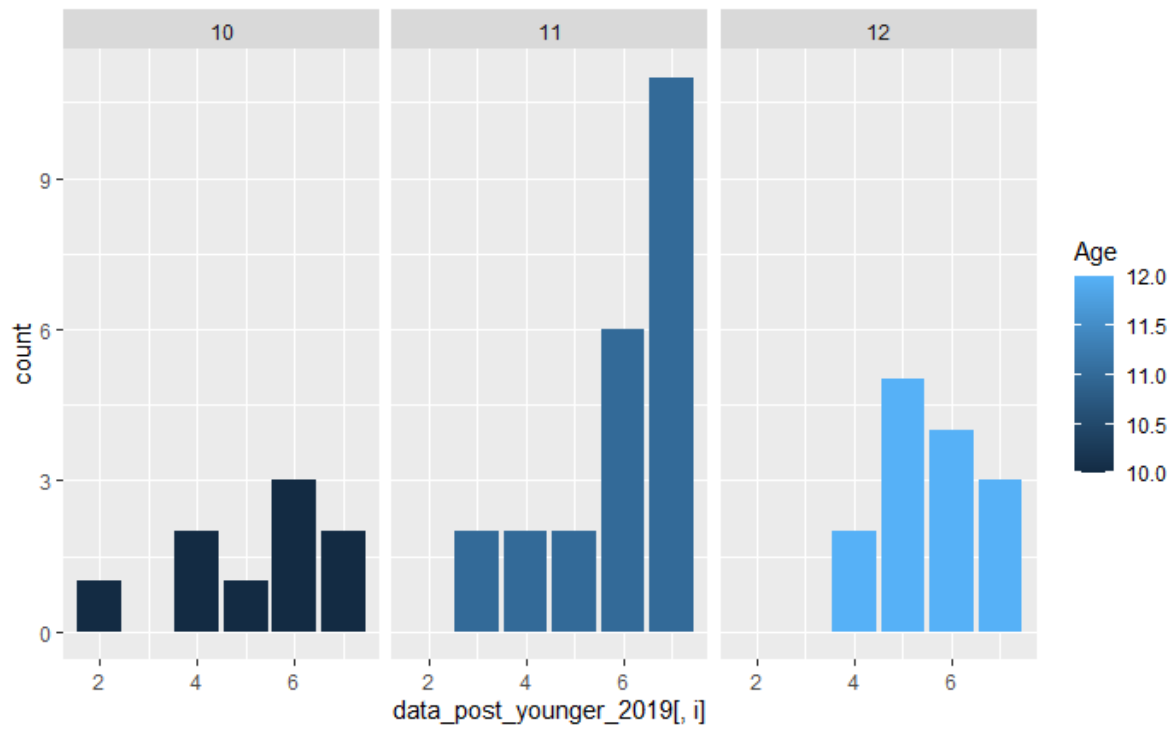
Q1

Q2

Q3

Q4

Q5

Q6

Q8

Q9

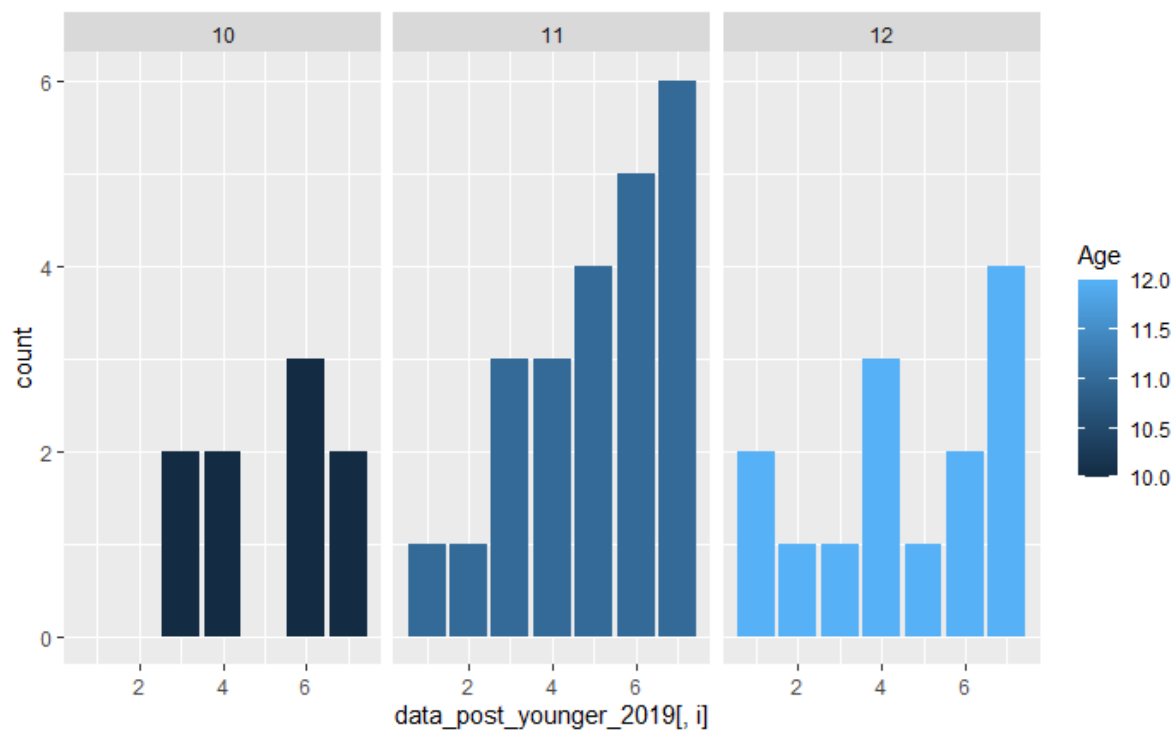Q10
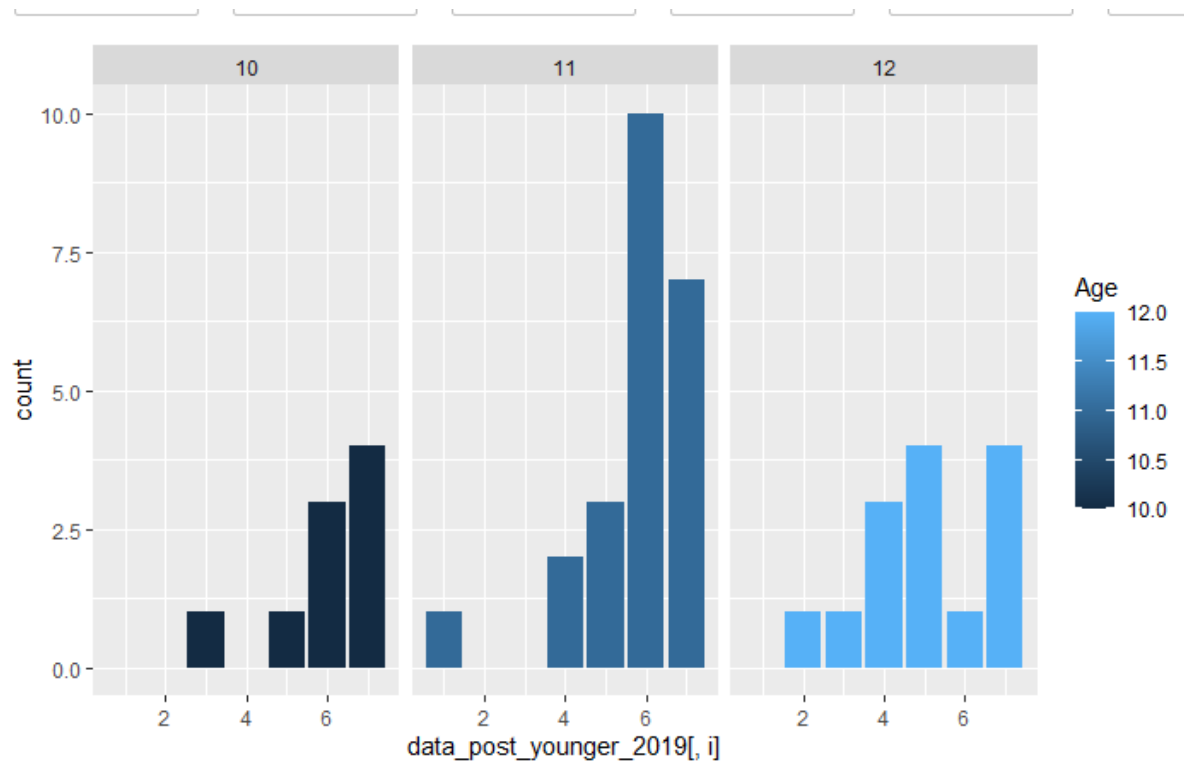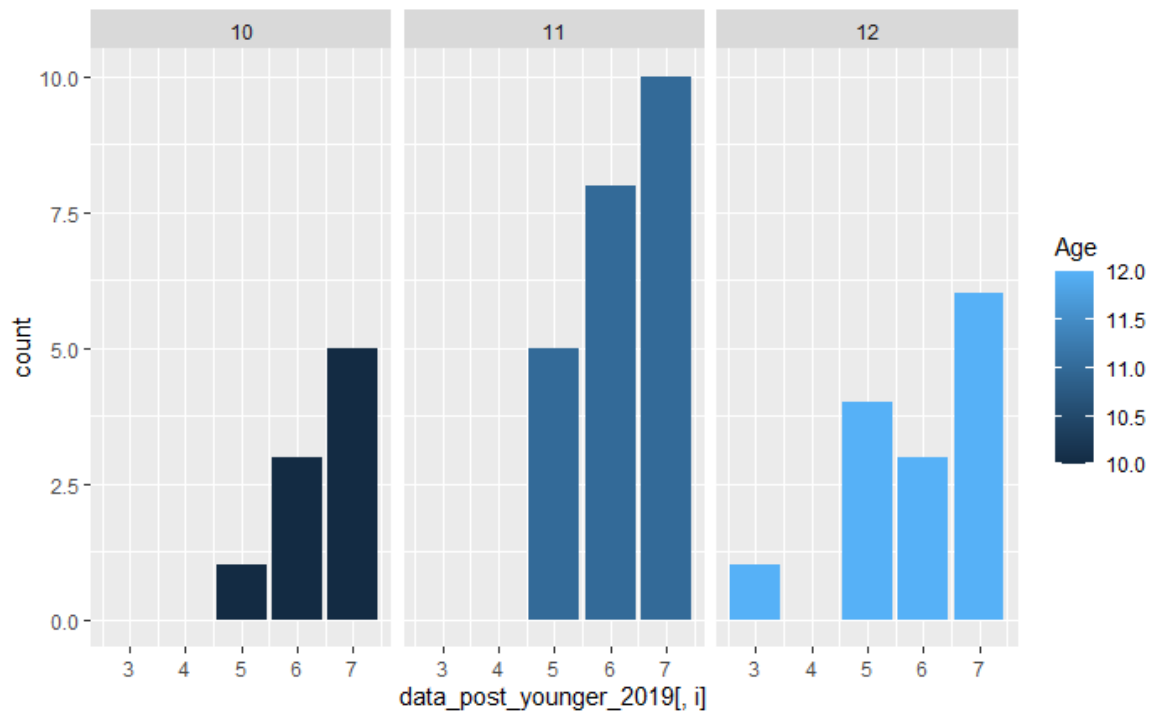
Q11
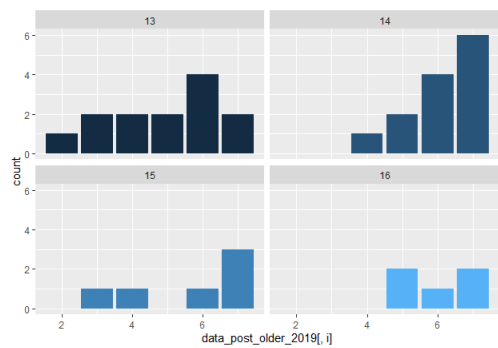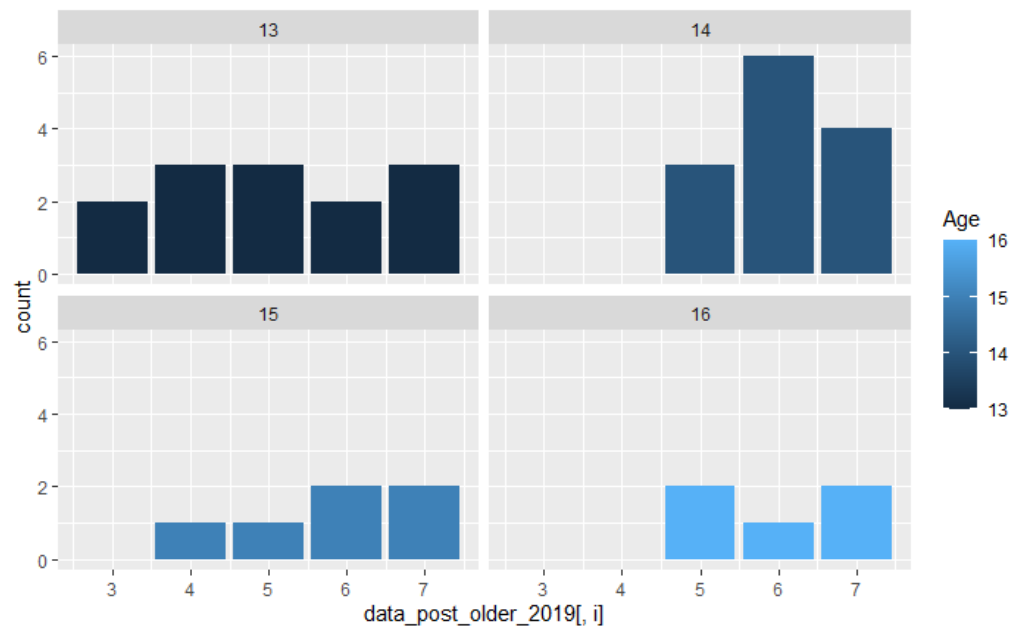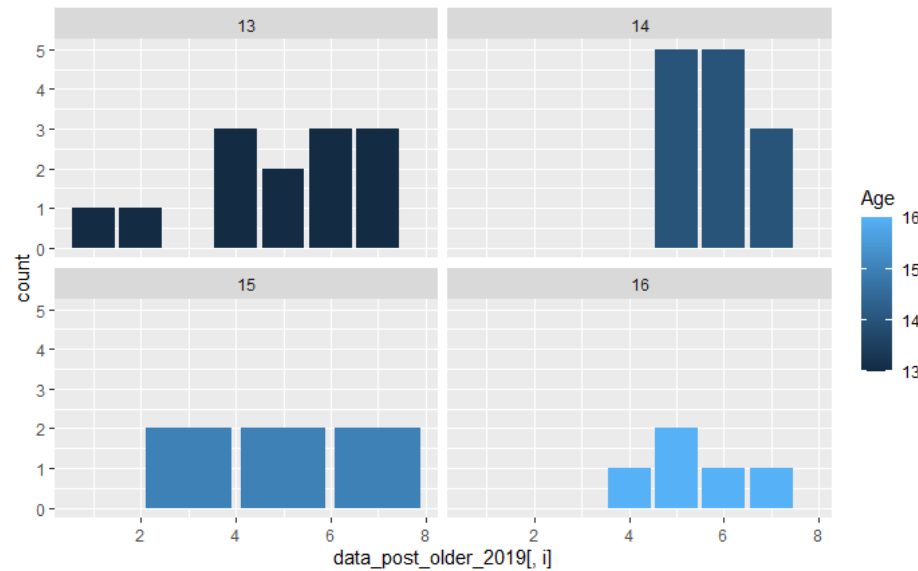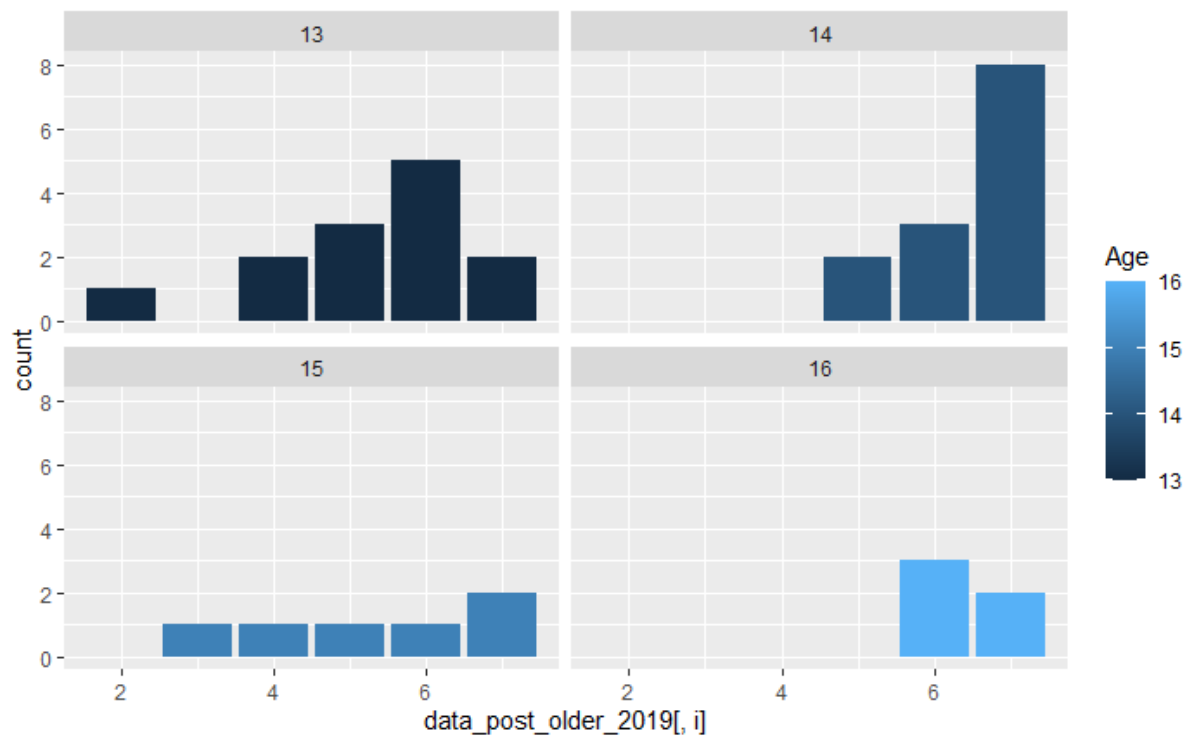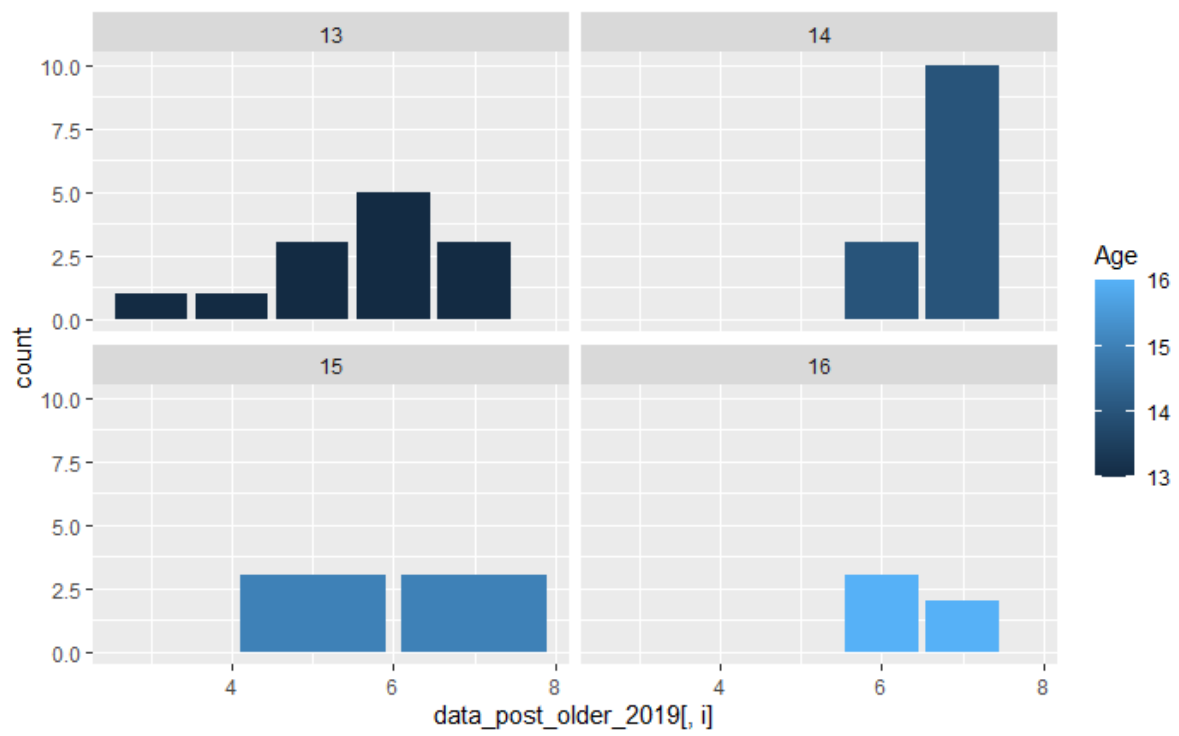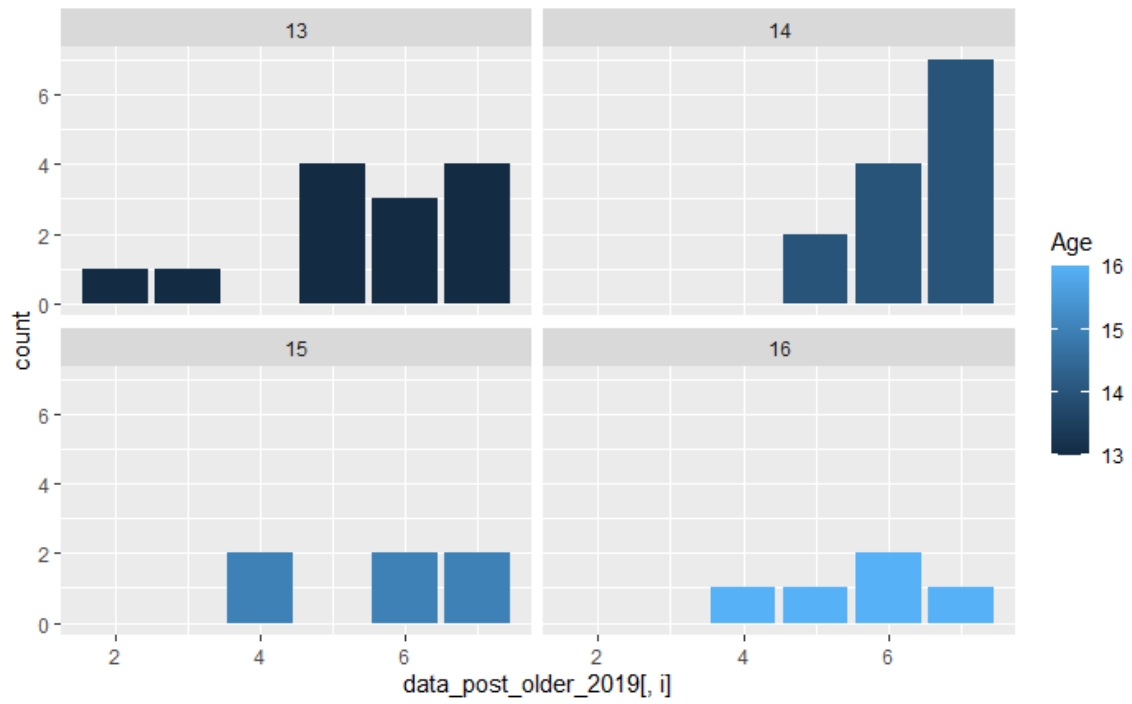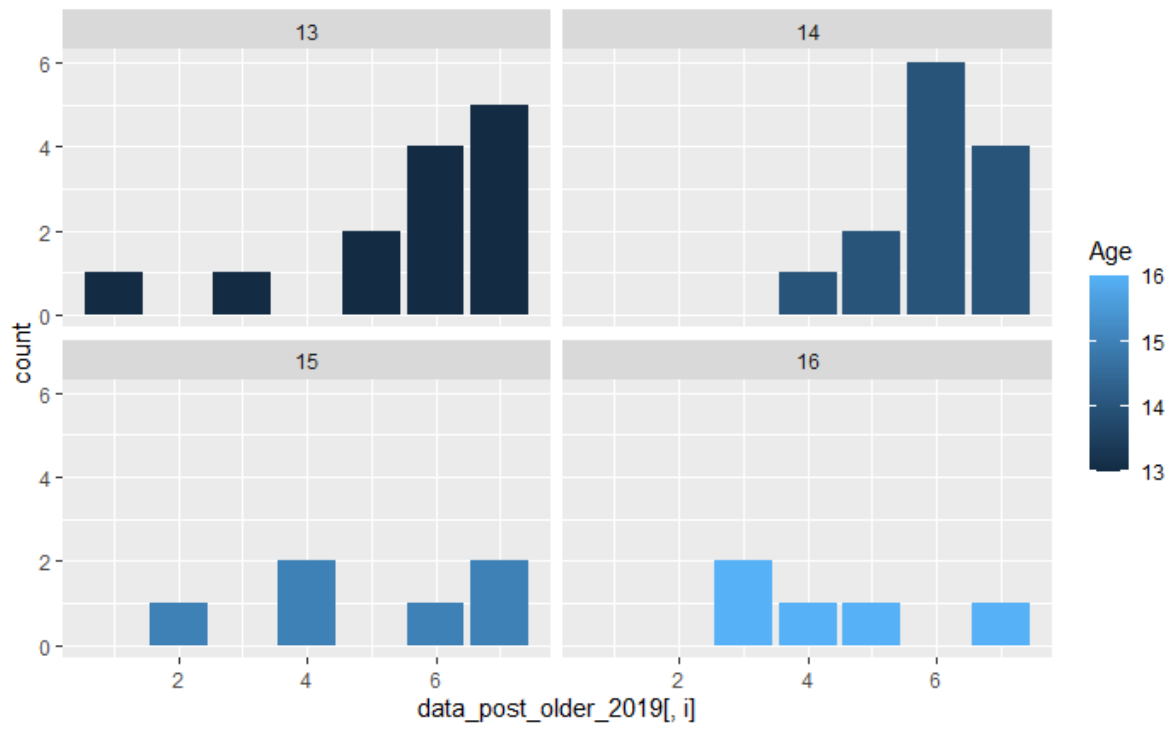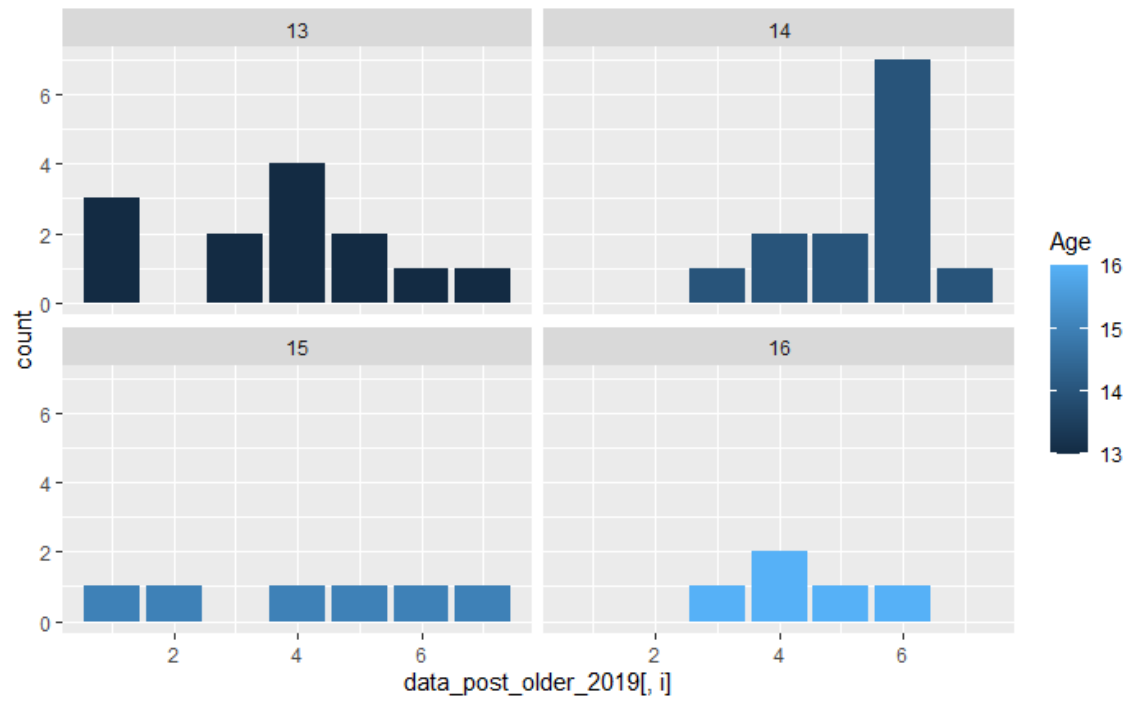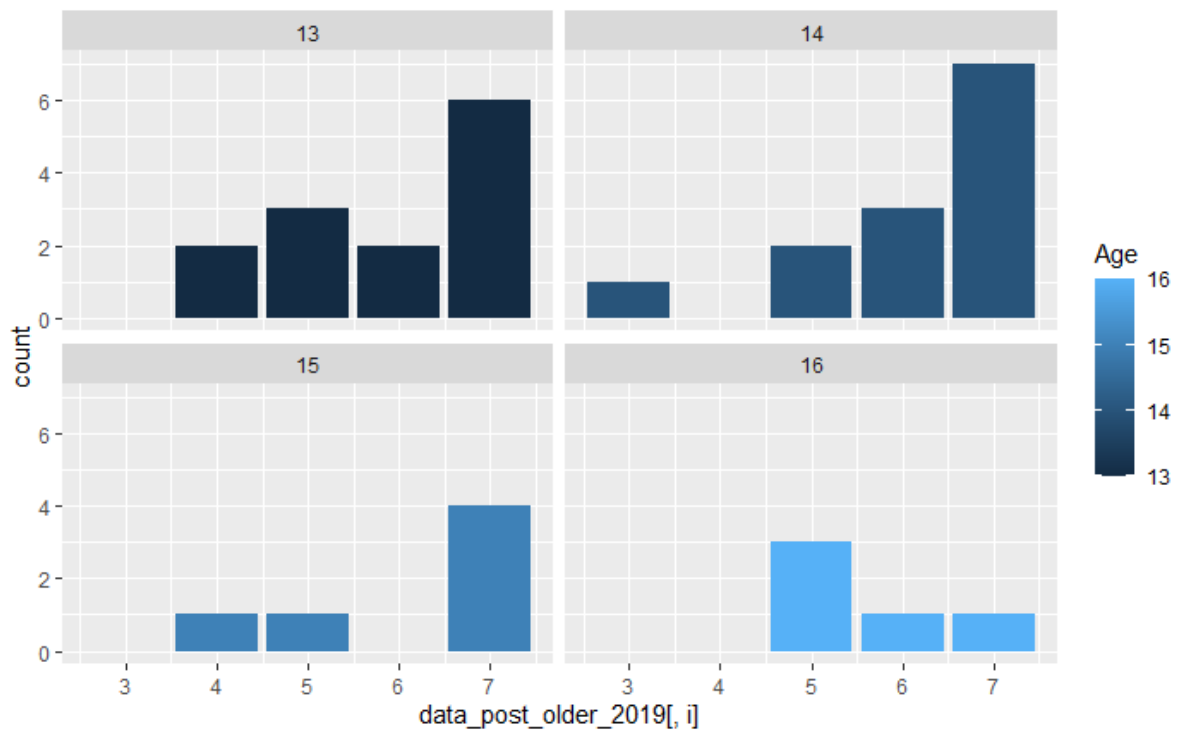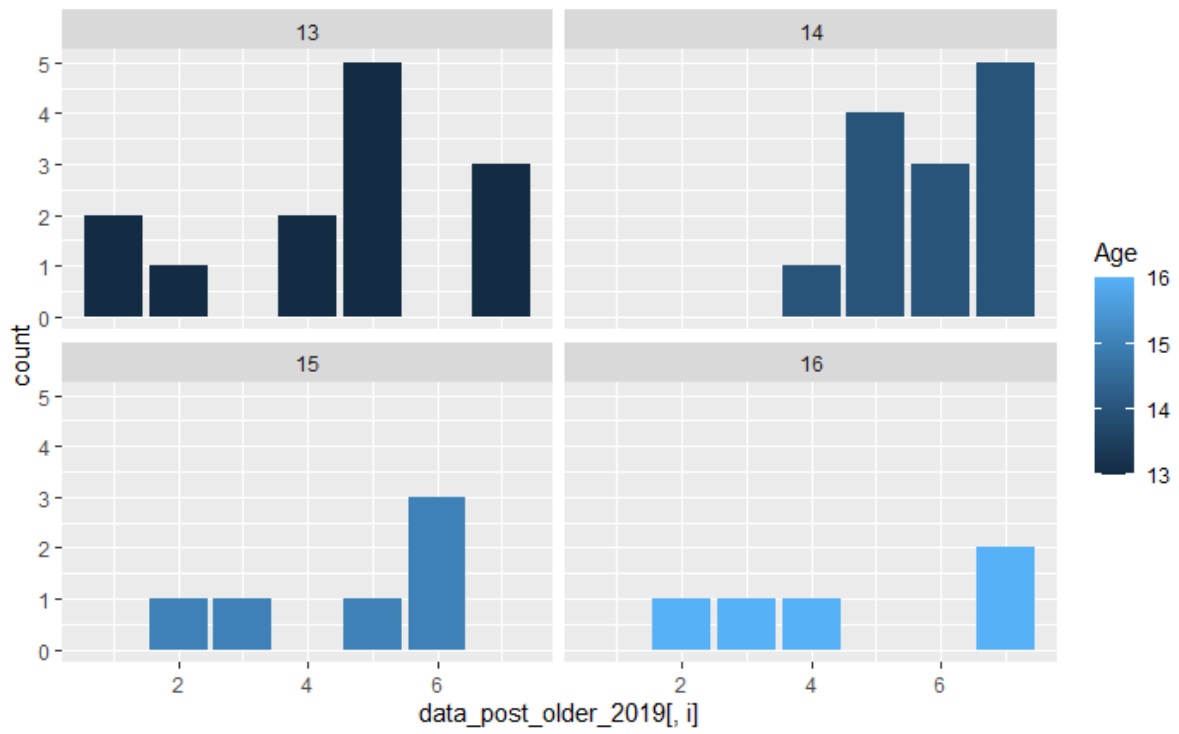
Q12

Q13

2019 younger post camp survey Age is factor

Q1

Q2

Q3
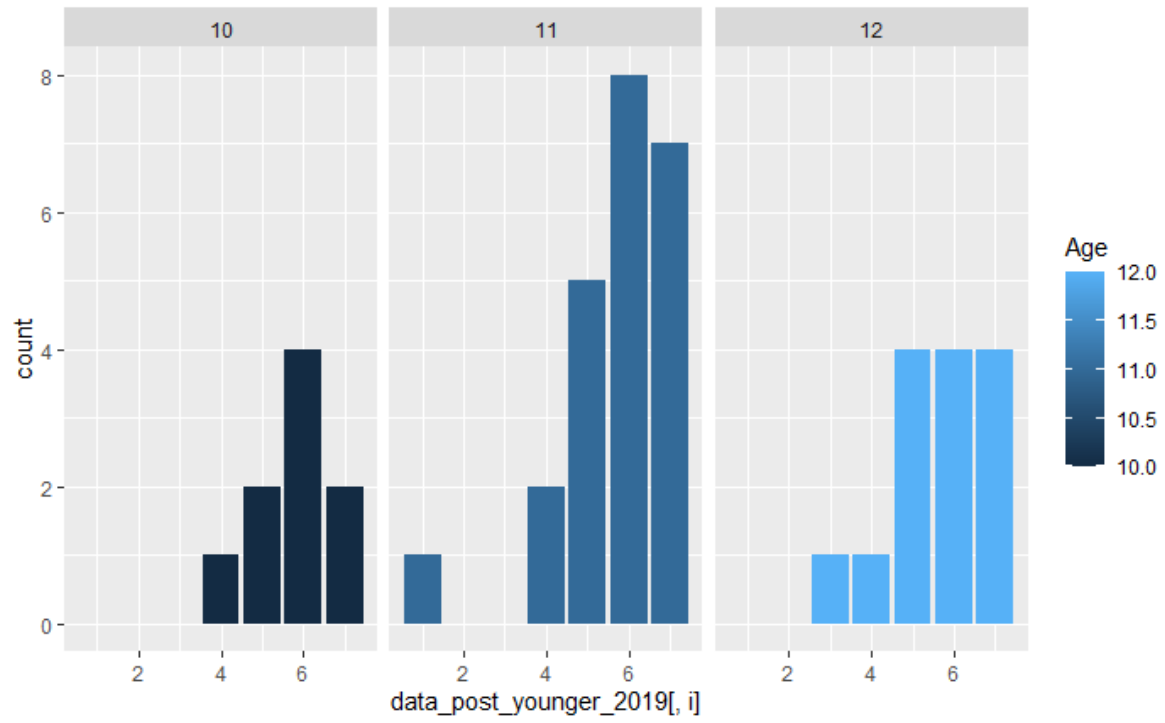
Q4

Q5

Q6

Q8
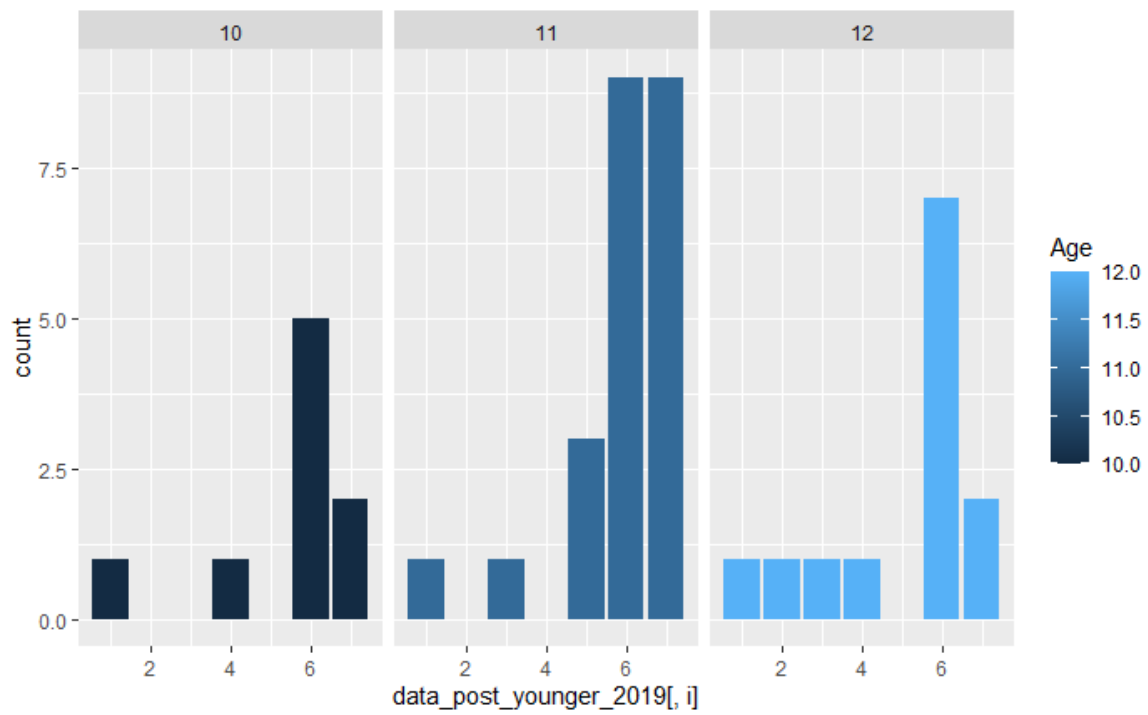
Q9
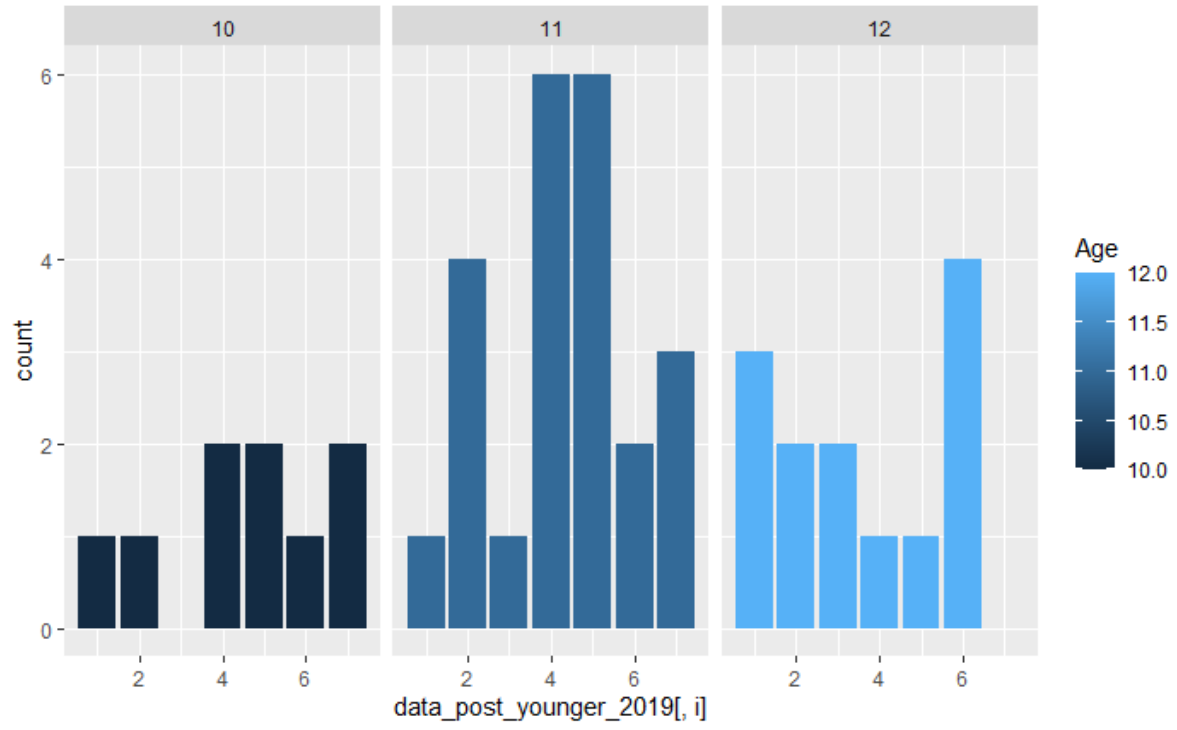
Q10

Q11

Q12

Q13

R output for Research Question 1

```
[1] "Q1"
Analysis of Variance Table

Response: value
            Df Sum Sq Mean Sq F value Pr(>F)
treatment    1   0.94  0.9404  0.5298 0.4677
Residuals  177 314.19  1.7751
[1] "Q2"
Analysis of Variance Table

Response: value
            Df Sum Sq Mean Sq F value Pr(>F)
treatment    1   3.87  3.8662  2.0772 0.1513
Residuals  177 329.44  1.8612
[1] "Q3"
Analysis of Variance Table

Response: value
            Df Sum Sq Mean Sq F value Pr(>F)
treatment    1   0.30 0.30035  0.1095 0.7411
Residuals  177 485.41 2.74242
[1] "Q4"
Analysis of Variance Table

Response: value
            Df Sum Sq Mean Sq F value Pr(>F)
treatment    1   0.22 0.22348     0.1 0.7522
Residuals  177 395.66 2.23539
[1] "Q5"
Analysis of Variance Table

Response: value
            Df  Sum Sq Mean Sq F value Pr(>F)
treatment    1   0.071 0.07124  0.0449 0.8325
Residuals  177 281.135 1.58834
[1] "Q6"
Analysis of Variance Table

Response: value
            Df  Sum Sq Mean Sq F value Pr(>F)
treatment    1   0.418 0.41831  0.2401 0.6248
Residuals  177 308.420 1.74248
[1] "Q7"
Analysis of Variance Table

Response: value
            Df Sum Sq Mean Sq F value Pr(>F)
treatment    1   2.14  2.1391  0.8875 0.3474
Residuals  177 426.61  2.4102
[1] "Q8"
Analysis of Variance Table
```
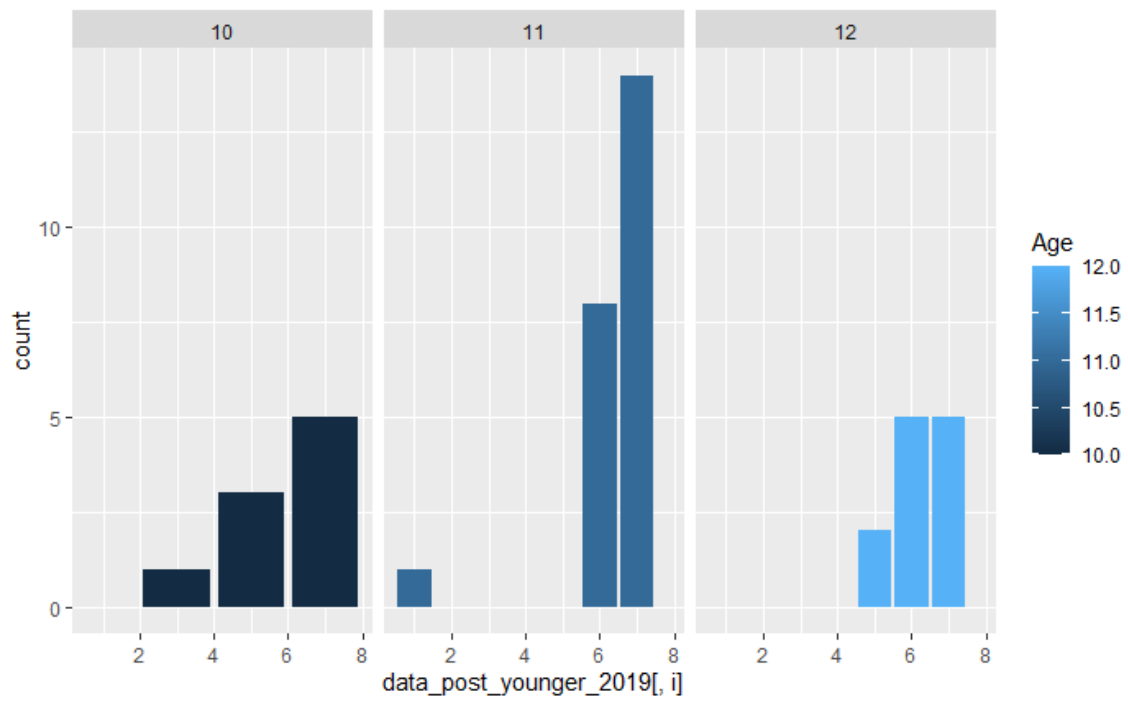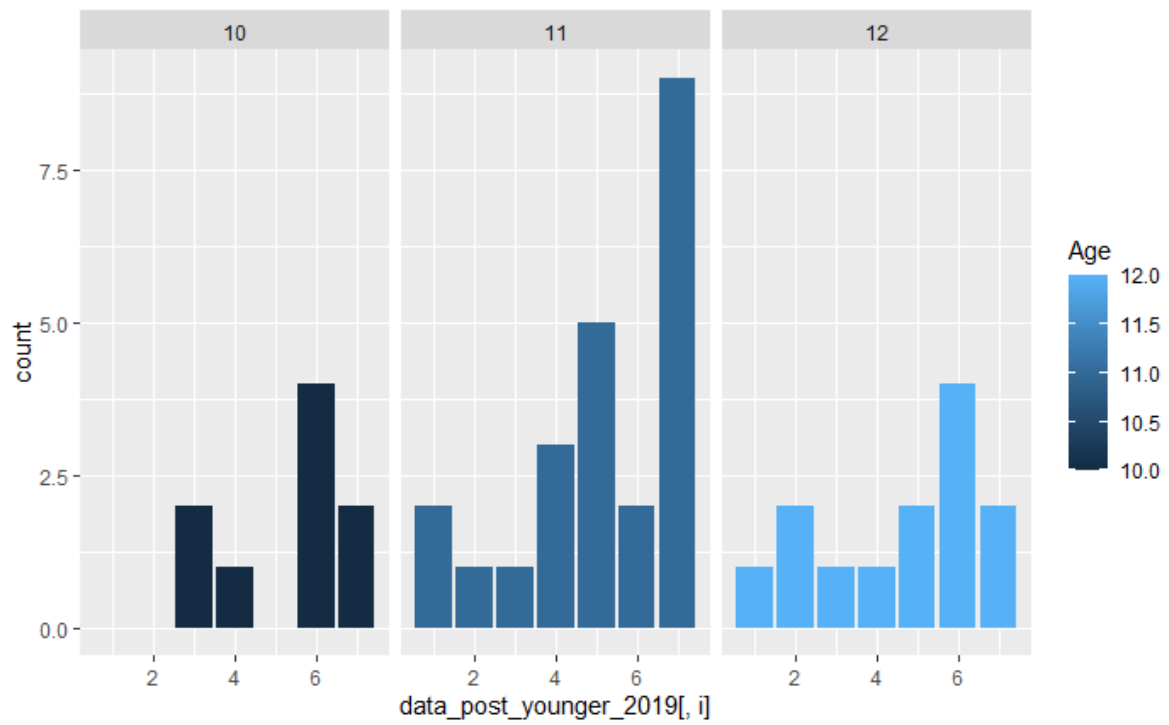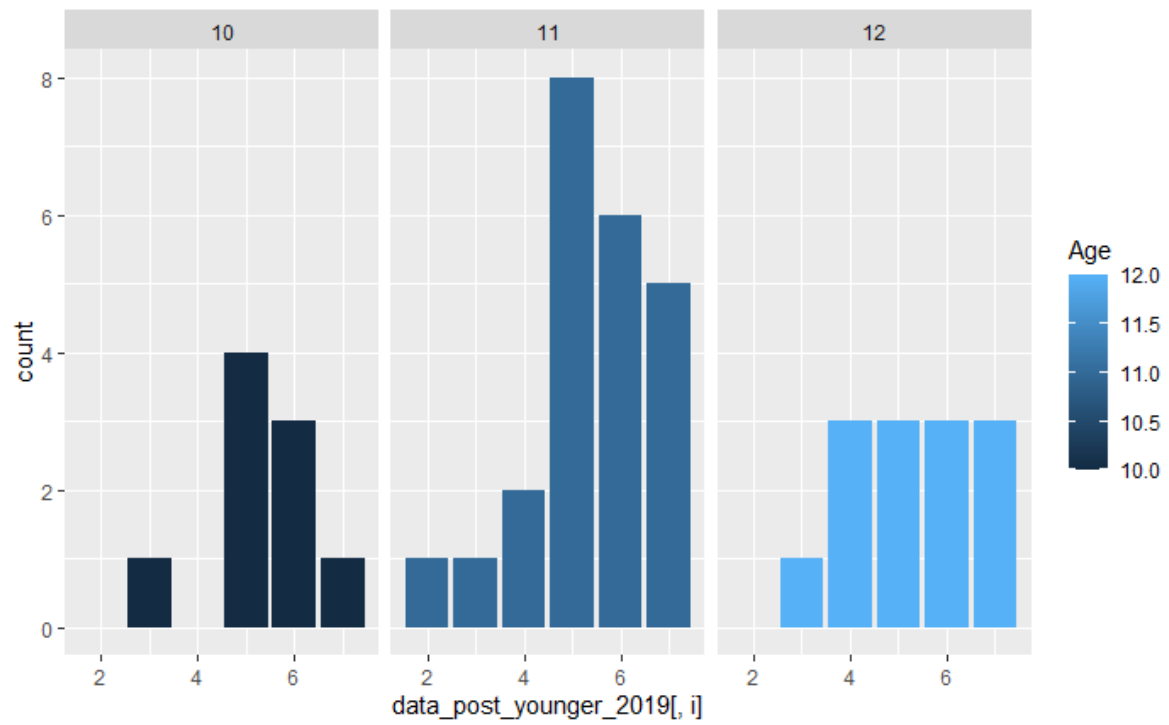
```
Response: value
          Df Sum Sq Mean Sq F value Pr(>F)
treatment   1   3.02  3.0201  1.1749 0.2799
Residuals 177 454.99  2.5706
[1] "Q9"
Analysis of Variance Table

Response: value
          Df Sum Sq Mean Sq F value Pr(>F)
treatment   1   3.88  3.8826  1.1013 0.2954
Residuals 177 624.01  3.5255
[1] "Q10"
Analysis of Variance Table

Response: value
          Df Sum Sq Mean Sq F value Pr(>F)
treatment   1   0.03 0.02913  0.0134 0.9081
Residuals 177 385.59 2.17848
[1] "Q11"
Analysis of Variance Table

Response: value
          Df Sum Sq Mean Sq F value  Pr(>F)
treatment   1  11.03 11.0282  4.5218 0.03485 *
Residuals 177 431.69  2.4389
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
[1] "Q12"
Analysis of Variance Table

Response: value
          Df Sum Sq Mean Sq F value Pr(>F)
treatment   1   0.08 0.08141  0.0418 0.8382
Residuals 177 344.44 1.94601
[1] "Q13"
Analysis of Variance Table

Response: value
          Df Sum Sq Mean Sq F value  Pr(>F)
treatment   1   7.89  7.8942  3.9503 0.04841 *
Residuals 177 353.71  1.9984
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
[1] "Q14"
Analysis of Variance Table

Response: value
          Df  Sum Sq Mean Sq F value Pr(>F)
treatment   1   0.317 0.31708  0.2069 0.6498
Residuals 177 271.292 1.53272
```
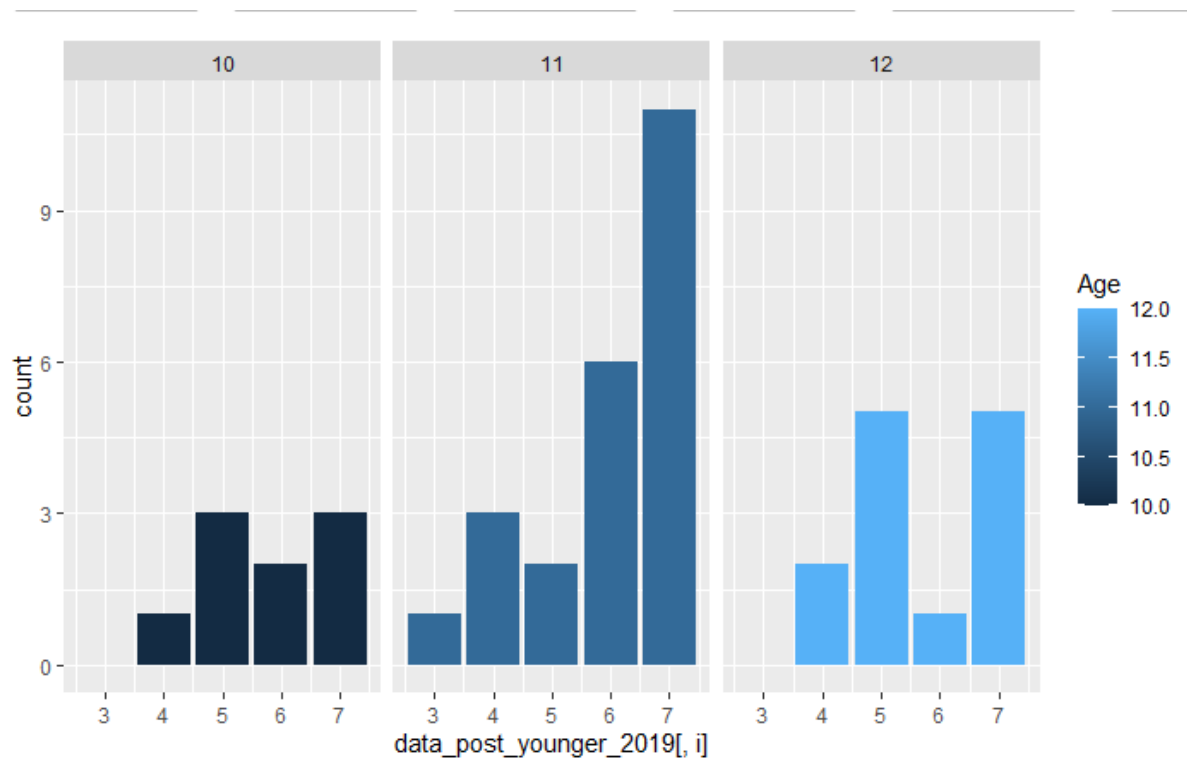
R output for Research Question 2

```
[1] "Q1"
Analysis of Variance Table

Response: value
           Df  Sum Sq Mean Sq F value Pr(>F)
treatment    3   3.043  1.0144  0.5688 0.6363
Residuals 175 312.085  1.7833
[1] "Q2"
Analysis of Variance Table

Response: value
           Df Sum Sq Mean Sq F value Pr(>F)
treatment    3   3.72  1.2390  0.6579  0.579
Residuals 175 329.59  1.8834
[1] "Q3"
Analysis of Variance Table

Response: value
           Df Sum Sq Mean Sq F value Pr(>F)
treatment    3   4.20  1.3988  0.5084  0.677
Residuals 175 481.51  2.7515
[1] "Q4"
Analysis of Variance Table

Response: value
           Df Sum Sq Mean Sq F value Pr(>F)
treatment    3   7.89  2.6285  1.1855 0.3168
Residuals 175 388.00  2.2172
[1] "Q5"
Analysis of Variance Table

Response: value
           Df  Sum Sq Mean Sq F value Pr(>F)
treatment    3  11.738  3.9127   2.541  0.058 .
Residuals 175 269.469  1.5398
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
[1] "Q6"
Analysis of Variance Table

Response: value
           Df  Sum Sq Mean Sq F value Pr(>F)
treatment    3   4.632  1.5439  0.8882 0.4485
Residuals 175 304.206  1.7383
[1] "Q7"
Analysis of Variance Table

Response: value
           Df Sum Sq Mean Sq F value Pr(>F)
treatment    3  10.73  3.5777  1.4978 0.2169
Residuals 175 418.02  2.3887
[1] "Q8"
Analysis of Variance Table
```

```
Response: value
            Df Sum Sq Mean Sq F value Pr(>F)
treatment    3   1.14 0.37908  0.1452 0.9326
Residuals  175 456.87 2.61071
[1] "Q9"
Analysis of Variance Table

Response: value
            Df Sum Sq Mean Sq F value Pr(>F)
treatment    3  12.87  4.2887  1.2203 0.3039
Residuals  175 615.02  3.5144
[1] "Q10"
Analysis of Variance Table

Response: value
            Df Sum Sq Mean Sq F value Pr(>F)
treatment    3   4.97  1.6583  0.7624 0.5166
Residuals  175 380.65  2.1751
[1] "Q11"
Analysis of Variance Table

Response: value
            Df Sum Sq Mean Sq F value Pr(>F)
treatment    3  13.50  4.4986  1.8342 0.1427
Residuals  175 429.22  2.4527
[1] "Q12"
Analysis of Variance Table

Response: value
            Df Sum Sq Mean Sq F value Pr(>F)
treatment    3   0.68 0.22613  0.1151 0.9512
Residuals  175 343.85 1.96484
[1] "Q13"
Analysis of Variance Table

Response: value
            Df Sum Sq Mean Sq F value Pr(>F)
treatment    3  12.20  4.0665  2.0367 0.1105
Residuals  175 349.41  1.9966
[1] "Q14"
Analysis of Variance Table

Response: value
            Df  Sum Sq Mean Sq F value Pr(>F)
treatment    3   4.343  1.4477  0.9479 0.4188
Residuals  175 267.266  1.5272
```

R output for Research Question 3:

```
package �tidyr� was built under R version 3.6.3[1] "Q1"
Analysis of Variance Table

Response: value
           Df  Sum Sq Mean Sq F value Pr(>F)
treatment   6   2.425 0.40412  0.2223 0.9692
Residuals 172 312.704 1.81805
[1] "Q2"
Analysis of Variance Table

Response: value
           Df Sum Sq Mean Sq F value Pr(>F)
treatment   6   8.29  1.3817  0.7312 0.6251
Residuals 172 325.02  1.8896
[1] "Q3"
Analysis of Variance Table

Response: value
           Df Sum Sq Mean Sq F value Pr(>F)
treatment   6   7.87  1.3123  0.4724 0.8282
Residuals 172 477.84  2.7781
[1] "Q4"
Analysis of Variance Table

Response: value
           Df Sum Sq Mean Sq F value Pr(>F)
treatment   6  11.72  1.9534  0.8746 0.5148
Residuals 172 384.17  2.2335
[1] "Q5"
Analysis of Variance Table

Response: value
           Df  Sum Sq Mean Sq F value Pr(>F)
treatment   6   8.505  1.4174   0.894 0.5006
Residuals 172 272.702  1.5855
[1] "Q6"
Analysis of Variance Table

Response: value
           Df  Sum Sq Mean Sq F value Pr(>F)
treatment   6  12.845  2.1409   1.244 0.2862
Residuals 172 295.993  1.7209
[1] "Q7"
Analysis of Variance Table

Response: value
           Df Sum Sq Mean Sq F value Pr(>F)
treatment   6  13.22  2.2039  0.9122 0.4875
Residuals 172 415.53  2.4158
[1] "Q8"
Analysis of Variance Table
```

```
Response: value
            Df Sum Sq Mean Sq F value Pr(>F)
treatment    6  18.99  3.1650    1.24 0.2882
Residuals  172 439.02  2.5524
[1] "Q9"
Analysis of Variance Table

Response: value
            Df Sum Sq Mean Sq F value Pr(>F)
treatment    6  32.02  5.3371  1.5406 0.1676
Residuals  172 595.87  3.4643
[1] "Q10"
Analysis of Variance Table

Response: value
            Df Sum Sq Mean Sq F value Pr(>F)
treatment    6   6.29  1.0482  0.4753 0.8261
Residuals  172 379.33  2.2054
[1] "Q11"
Analysis of Variance Table

Response: value
            Df Sum Sq Mean Sq F value    Pr(>F)
treatment    6  49.63  8.2725  3.6198 0.002087 **
Residuals  172 393.08  2.2854
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
[1] "Q12"
Analysis of Variance Table

Response: value
            Df Sum Sq Mean Sq F value Pr(>F)
treatment    6  10.14  1.6895   0.869 0.5189
Residuals  172 334.39  1.9441
[1] "Q13"
Analysis of Variance Table

Response: value
            Df Sum Sq Mean Sq F value Pr(>F)
treatment    6  15.64  2.6067  1.2959 0.2615
Residuals  172 345.97  2.0114
[1] "Q14"
Analysis of Variance Table

Response: value
            Df  Sum Sq Mean Sq F value Pr(>F)
treatment    6  10.708  1.7846  1.1765  0.321
Residuals  172 260.901  1.5169
```