Equity and Efficiency in Patient Care

~Identifying gaps in care delivery, treatment delays, and demographic disparities to promote equitable and efficient patient care across all populations~

~EQUITABLE HEALTHCARE~

Patient outcomes, access to care, and quality of treatment should not systematically differ because of age, gender, ethnicity, socioeconomic status, disability, or location.

RESEARCH QUESTION:
are some patient groups disadvantaged in access, waiting time, attendance, or outcomes — even when clinical need is similar?

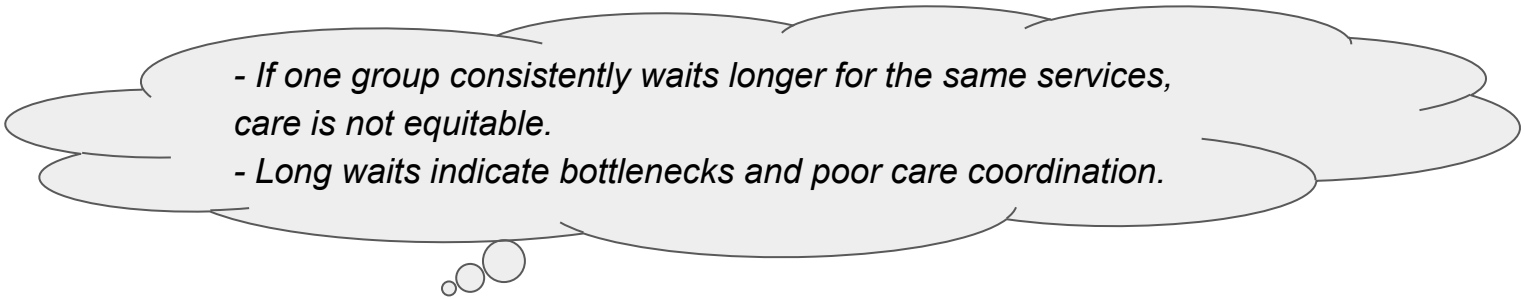
Abstract data from tables using date of birth, gender, registration date and treatment date…

KPI1: wait tme

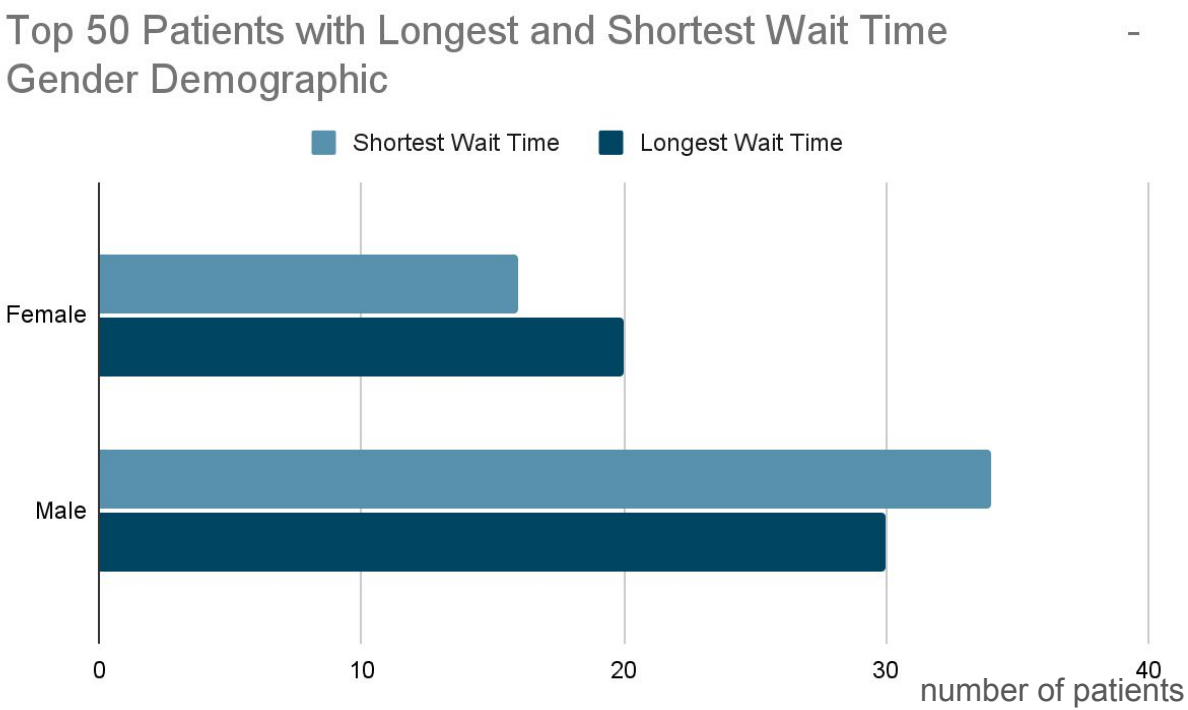
HOW LONG ARE PATIENTS WAITING FOR THEIR APPOINTMENTS?

MEASURE: time from referral (registration date)→ first appointment (appointment date)

COMPARE: patient demographic



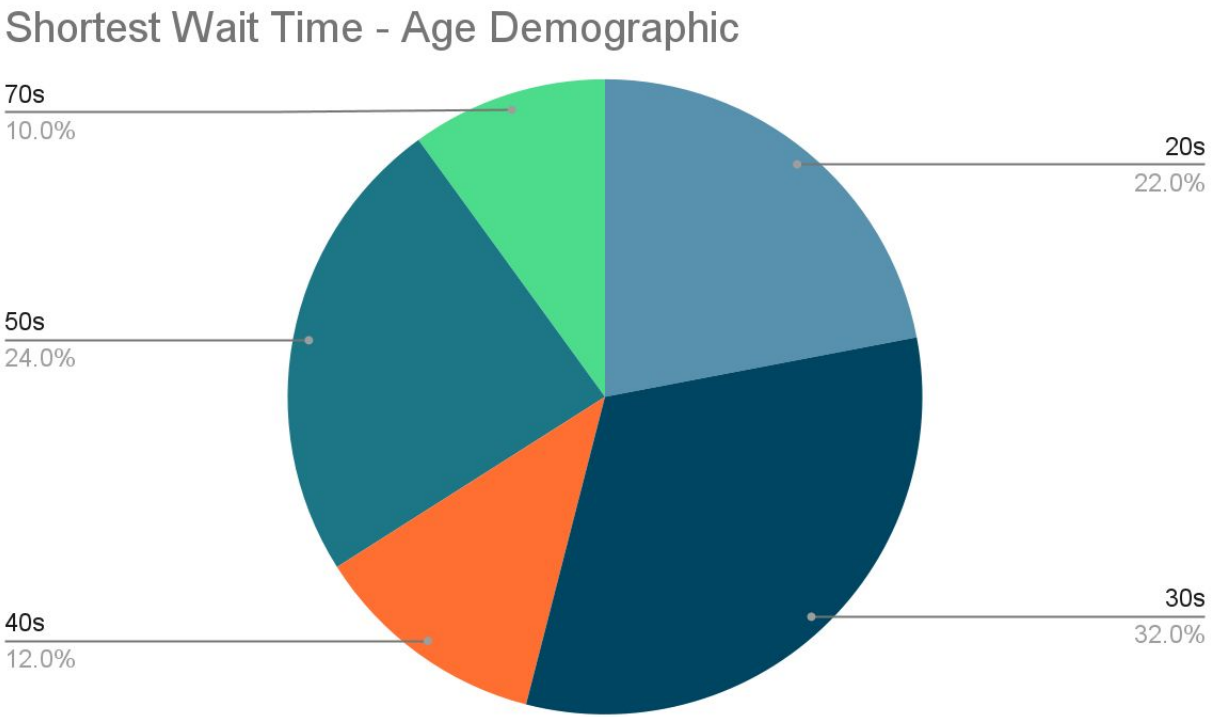
FINDINGS: COMPARISON BY GENDER



Limiting patients to top 50 to analyse the demographic evenly

Among the 50 patients with the shortest wait times, males represented a larger proportion (68%) compared to females (32%) whereas among the 50 patients with the longest wait times, the gender distribution was more balanced, with males accounting for 60% and females 40%. This indicates there is a smaller gender gap among patients experiencing the longest waits.

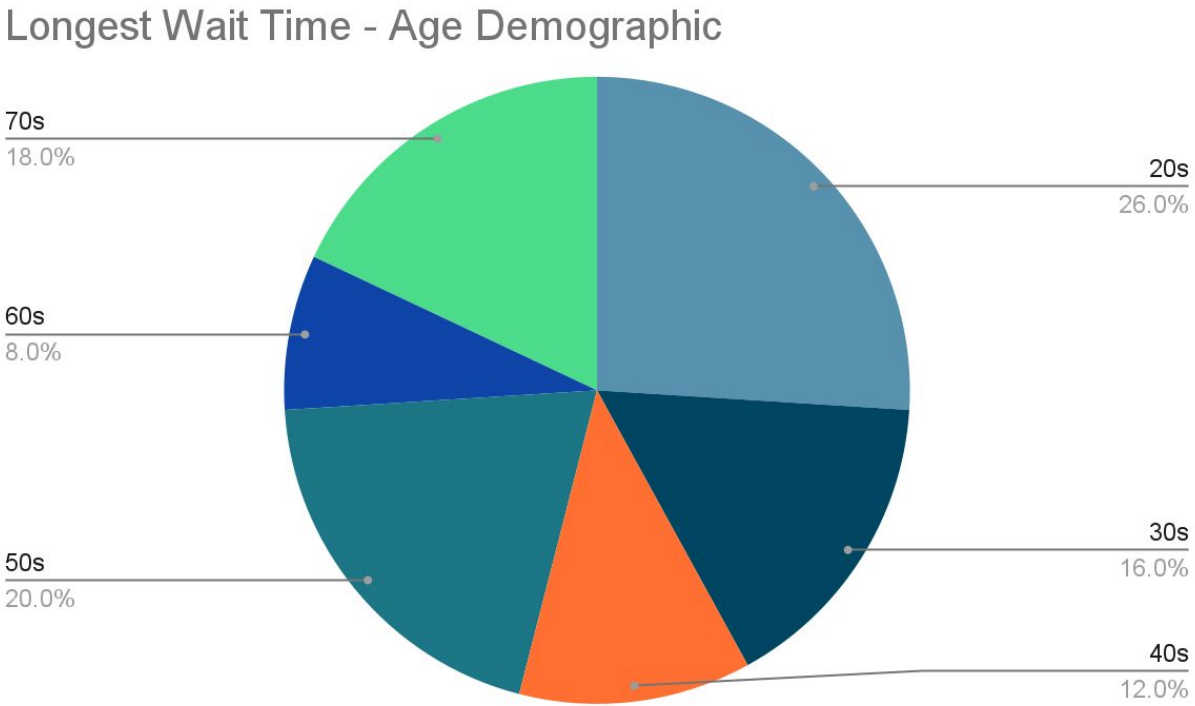
FINDINGS: COMPARISON BY AGE GROUP



Among the 50 patients with the shortest wait times, the largest portions were in their 30s, 50s, 20s.

Limiting patients to top 50 to analyse the demographic evenly

FINDINGS: COMPARISON BY AGE GROUP



Limiting patients to top 50 to analyse the demographic evenly

In contrast, patients in their 20s, 50s, 70s were the largest portions in longest wait time.

Comparison of two cohorts shows a shift in age comparison, with younger adults in their 20s and older adults in their 70s appearing more frequently in the longest wait-time group compared to the shortest wait-time whereas patients in their 30s seem to appear more frequently in the shortest wait times compared to the longest wait-time.

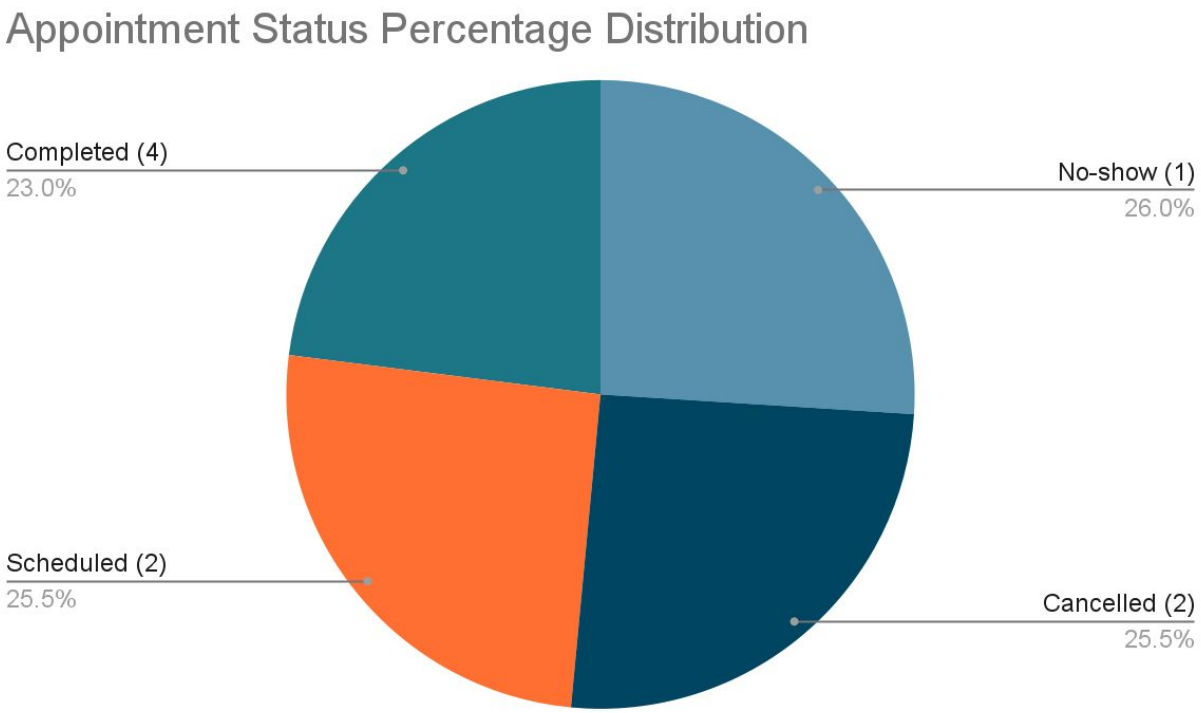
KPI2: appointment completion rate

HOW MANY PATIENTS COMPLETED THEIR APPOINTMENTS?

MEASURE: percentage of appointments with each status (cancelled, no-shows, scheduled, completed)
COMPARE: completed appointments to missed appointments and their patient demographics

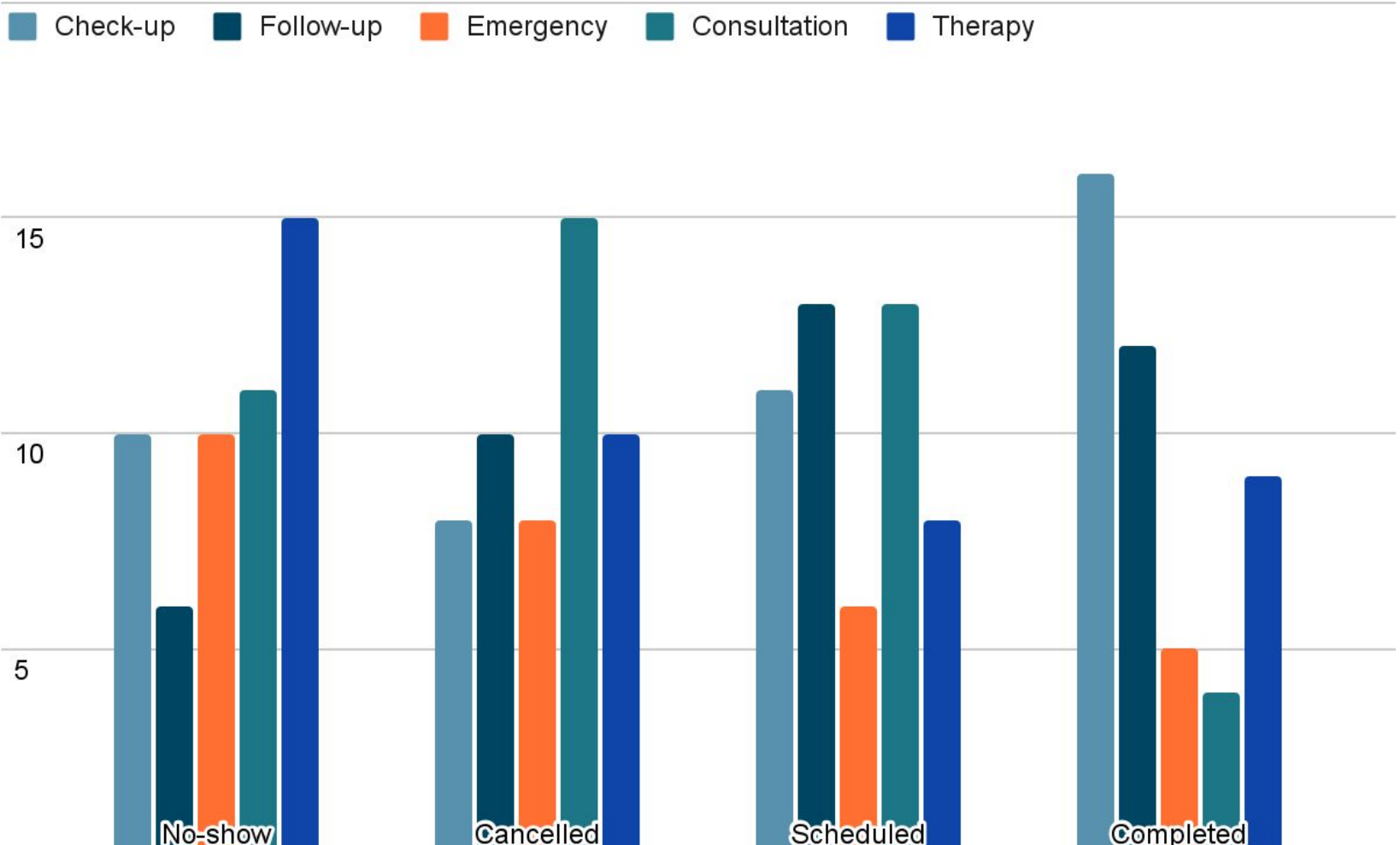
- Lower completion rates may signal access barriers such as transport, work flexibility, and language.
- Missed appointments waste clinical time and resources.

FINDINGS: STATUS DISTRIBUTION



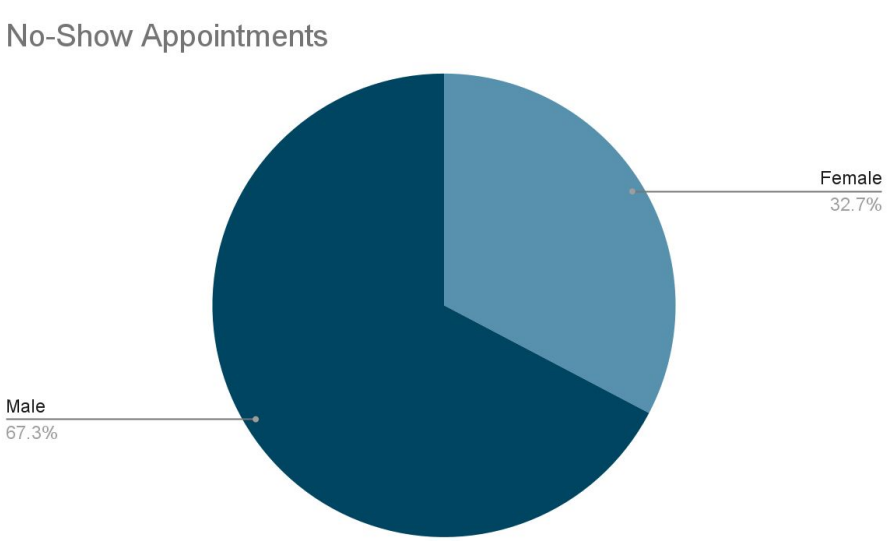
Among the 200 appointments recorded, there were almost equal distribution between the 4 status. There were slightly more missed appointments, including no-shows and cancellations, suggesting potential opportunities for improvement through analysis on appointment type, departments and patient demographics of those appointments.

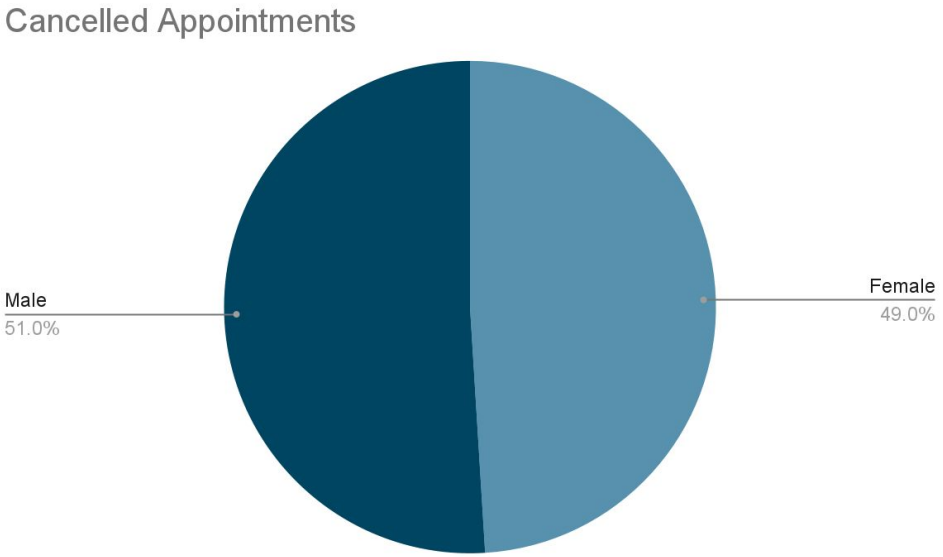
FINDINGS: STATUS BY APPOINTMENT TYPE



Focusing on the appointment type of each status, we can see therapy and consultation having the most no-shows and cancellations, and also being one of the least completed appointment types, implying these are the areas for improvement whether it being cancellation fees or improvement in quality of service.

FINDINGS: NO-SHOWS AND CANCELS BY GENDER



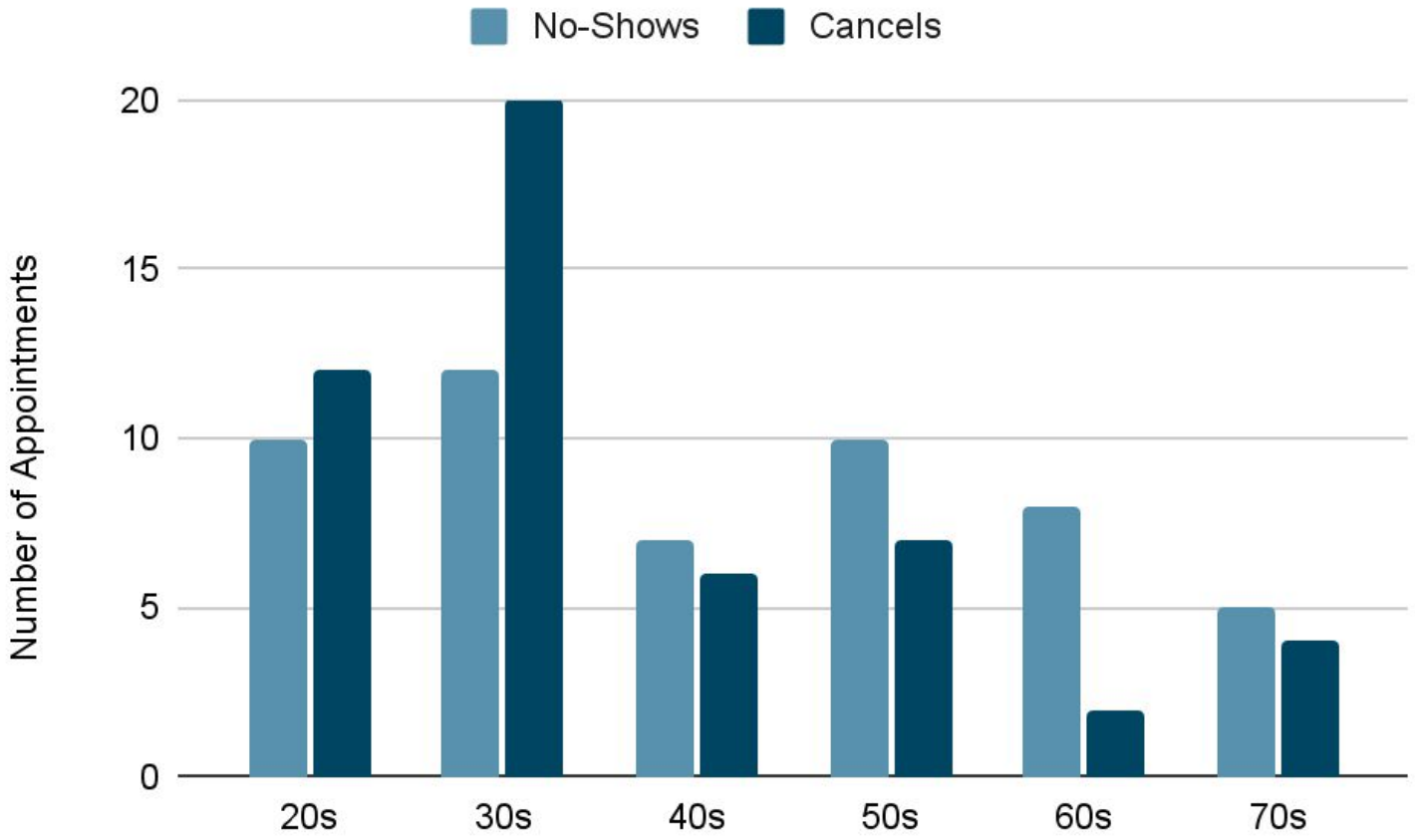


Among the 52 no-show appointments, 17 were female, 35 were male, and the gender ratio was 7:3 (male:female).

Among the 51 cancelled appointments, 25 were female, 26 were male, and the gender ratio was 5:5 (male:female).

This implies about the same amount of males and females cancel their appointments, but the majority of appointments missed without notice are with male patients.

FINDINGS: NO-SHOWS AND CANCELS BY AGE GROUP



30s and 20s had the highest numbers of cancelled and no-show appointments, and both had more cancellations than no-shows, whereas older age groups showed more no-shows than cancelled. This could imply difficulties for older generations in using technology and systems to cancel their appointments in advance.

SUMMARY

This project has focused on equity and efficiency in patient care. The findings were:

1. Males and patients in their 30s represented a larger proportion in shortest wait times, whereas females and younger adults in their 20s and older adults in their 70s seemed to appear more frequently in the shortest wait times.
2. More than half of the 200 appointments were either no-shows or cancellations. Within the missed appointment status, therapy and consultation were the largest portions, suggesting opportunity for change in those departments.
3. There were more no-shows than cancellations in older generations, whereas opposite was true for younger generations in their 20s and 30s.
4. Most cancellations were made by patients in their 30s. (40% of all cancelled appointments.)
5. Majority of no-shows were by male patients.

Improvement suggestions:

Monitor equity in wait times / Introduce cancellation fee system, and no-show penalty system / Improve quality of service / Introduce rewards system / Introduce additional technology support for older generations

	patient_id	registration_date	treatment_date	days_taken_until	gender	date_of_birth	age	treatment_type
2	P045	2021-01-23	2023-10-26	0-0 1006 0:0:0	F	1966-04-25	0-0 59 19:12:0	Chemotherapy
3	P039	2021-03-09	2023-12-17	0-0 1013 0:0:0	F	1950-12-12	0-0 75 4:16:26.3	Chemotherapy
4	P017	2022-09-26	2023-01-17	0-0 113 0:0:0	M	1991-05-01	0-0 34 18:24:39.	X-Ray
5	P019	2023-06-24	2023-10-25	0-0 123 0:0:0	M	1975-05-24	0-0 50 17:9:41.9	X-Ray
6	P035	2023-07-09	2023-11-13	0-0 127 0:0:0	F	1993-04-13	0-0 32 19:31:43.	Physiotherapy
7	P035	2023-07-09	2023-11-15	0-0 129 0:0:0	F	1993-04-13	0-0 32 19:31:43.	Chemotherapy
8	P019	2023-06-24	2023-11-01	0-0 130 0:0:0	M	1975-05-24	0-0 50 17:9:41.9	MRI
9	P049	2023-06-14	2023-10-25	0-0 133 0:0:0	M	1972-11-26	0-0 53 4:55:53.4	X-Ray
10	P048	2023-06-19	2023-11-06	0-0 140 0:0:0	M	1983-03-24	0-0 42 21:2:27.9	ECG
11	P012	2023-04-27	2023-09-21	0-0 147 0:0:0	F	1991-12-08	0-0 34 3:52:46.0	MRI
12	P017	2022-09-26	2023-02-23	0-0 150 0:0:0	M	1991-05-01	0-0 34 18:24:39.	MRI
13	P018	2022-09-23	2023-03-09	0-0 167 0:0:0	M	1979-09-24	0-0 46 9:0:29.58	X-Ray
14	P036	2022-10-04	2023-03-21	0-0 168 0:0:0	M	1997-12-26	0-0 28 2:33:51.7	Chemotherapy
15	P019	2023-06-24	2023-12-20	0-0 179 0:0:0	M	1975-05-24	0-0 50 17:9:41.9	ECG
16	P029	2023-04-19	2023-05-07	0-0 18 0:0:0	M	2005-05-15	0-0 20 17:13:38.	Chemotherapy
17	P009	2022-09-18	2023-03-21	0-0 184 0:0:0	M	1971-12-11	0-0 54 4:0:39.45	ECG
18	P012	2023-04-27	2023-10-29	0-0 185 0:0:0	F	1991-12-08	0-0 34 3:52:46.0	Chemotherapy
19	P012	2023-04-27	2023-10-31	0-0 187 0:0:0	F	1991-12-08	0-0 34 3:52:46.0	Chemotherapy
20	P050	2023-04-28	2023-11-07	0-0 193 0:0:0	M	1993-12-27	0-0 32 2:33:51.7	ECG
21	P049	2023-06-14	2023-12-26	0-0 195 0:0:0	M	1972-11-26	0-0 53 4:55:53.4	X-Ray
22	P036	2022-10-04	2023-04-18	0-0 196 0:0:0	M	1997-12-26	0-0 28 2:33:51.7	MRI
23	P036	2022-10-04	2023-04-18	0-0 196 0:0:0	M	1997-12-26	0-0 28 2:33:51.7	ECG
24	P035	2023-07-09	2023-07-29	0-0 20 0:0:0	F	1993-04-13	0-0 32 19:31:43.	Chemotherapy
25	P044	2023-01-26	2023-08-16	0-0 202 0:0:0	F	1976-03-11	0-0 49 21:57:41.	MRI
26	P011	2022-09-27	2023-04-18	0-0 203 0:0:0	F	1966-12-04	0-0 59 4:32:13.1	Chemotherapy
27	P001	2022-06-23	2023-01-16	0-0 207 0:0:0	F	1955-06-04	0-0 70 16:46:1.6	Chemotherapy
28	P029	2023-04-19	2023-11-16	0-0 211 0:0:0	M	2005-05-15	0-0 20 17:13:38.	Chemotherapy
29	P009	2022-09-18	2023-04-17	0-0 211 0:0:0	M	1971-12-11	0-0 54 4:0:39.45	Chemotherapy
30	P010	2022-08-24	2023-03-27	0-0 215 0:0:0	M	2001-10-13	0-0 24 7:21:51.7	Chemotherapy
31	P001	2022-06-23	2023-01-26	0-0 217 0:0:0	F	1955-06-04	0-0 70 16:46:1.6	ECG
32	P017	2022-09-26	2023-05-01	0-0 217 0:0:0	M	1991-05-01	0-0 34 18:24:39.	Chemotherapy
33	P036	2022-10-04	2023-05-12	0-0 220 0:0:0	M	1997-12-26	0-0 28 2:33:51.7	Physiotherapy
34	P043	2022-07-18	2023-03-03	0-0 228 0:0:0	M	1980-03-25	0-0 45 20:58:31.	X-Ray
35	P029	2023-04-19	2023-12-14	0-0 239 0:0:0	M	2005-05-15	0-0 20 17:13:38.	ECG
36	P012	2023-04-27	2023-12-26	0-0 243 0:0:0	F	1991-12-08	0-0 34 3:52:46.0	X-Ray
37	P010	2022-08-24	2023-04-26	0-0 245 0:0:0	M	2001-10-13	0-0 24 7:21:51.7	MRI
38	P041	2022-07-16	2023-04-08	0-0 266 0:0:0	M	1951-06-19	0-0 74 15:50:47.	X-Ray
39	P041	2022-07-16	2023-04-15	0-0 273 0:0:0	M	1951-06-19	0-0 74 15:50:47.	MRI
40	P012	2023-04-27	2023-05-25	0-0 28 0:0:0	F	1991-12-08	0-0 34 3:52:46.0	ECG
41	P011	2022-09-27	2023-07-04	0-0 280 0:0:0	F	1966-12-04	0-0 59 4:32:13.1	MRI
42	P031	2022-06-28	2023-04-04	0-0 280 0:0:0	M	1987-01-14	0-0 39 1:30:44.3	MRI
43	P001	2022-06-23	2023-04-01	0-0 282 0:0:0	F	1955-06-04	0-0 70 16:46:1.6	Physiotherapy
44	P001	2022-06-23	2023-04-09	0-0 290 0:0:0	F	1955-06-04	0-0 70 16:46:1.6	Chemotherapy
45	P010	2022-08-24	2023-06-11	0-0 291 0:0:0	M	2001-10-13	0-0 24 7:21:51.7	X-Ray
46	P042	2022-03-15	2023-01-01	0-0 292 0:0:0	F	1954-08-22	0-0 71 11:34:21.	Chemotherapy
47	P043	2022-07-18	2023-05-08	0-0 294 0:0:0	M	1980-03-25	0-0 45 20:58:31.	Chemotherapy
48	P044	2023-01-26	2023-11-27	0-0 305 0:0:0	F	1976-03-11	0-0 49 21:57:41.	Chemotherapy
49	P018	2022-09-23	2023-08-08	0-0 319 0:0:0	M	1979-09-24	0-0 46 9:0:29.58	Chemotherapy
50	P019	2023-06-24	2023-07-26	0-0 32 0:0:0	M	1975-05-24	0-0 50 17:9:41.9	Physiotherapy
51	P009	2022-09-18	2023-08-16	0-0 332 0:0:0	M	1971-12-11	0-0 54 4:0:39.45	Chemotherapy
52	P010	2022-08-24	2023-07-23	0-0 333 0:0:0	M	2001-10-13	0-0 24 7:21:51.7	ECG
53	P041	2022-07-16	2023-06-15	0-0 334 0:0:0	M	1951-06-19	0-0 74 15:50:47.	ECG
54	P042	2022-03-15	2023-02-26	0-0 348 0:0:0	F	1954-08-22	0-0 71 11:34:21.	Physiotherapy
55	P049	2023-06-14	2023-07-19	0-0 35 0:0:0	M	1972-11-26	0-0 53 4:55:53.4	Chemotherapy

Input and output:

Average wait time, age findings: combined appointments and patients files using JOIN function, joining patient id.

My code:

```
SELECT patient id, registration date, treatment date, (treatment date -
registration date) as days taken until treatment completed , gender,
date of birth, cost, (current_date - date_of_birth)/365 as age,
treatment_type
FROM
utility-span-484509-m6.hospital_management.patients_and_appointments_joined
as pa
JOIN `utility-span-484509-m6.hospital_management.treatments`  AS t
ON pa.appointment_id = t.appointment_id
WHERE registration_date <= treatment_date
ORDER BY days_taken_until_treatment_completed
```

Link to full data set:

https://docs.google.com/spreadsheets/d/1Ah1ATb1t9pCH8cYpCNV8Yh0duxELOGCTweLdE9VtAw0/edit?usp=sharing

SQL input:

```sql
--what is the sum of status by reason for visit?
SELECT COUNT(*) AS sum, status, reason_for_visit
FROM `utility-span-484509-m6.hospital_management.appointments`
GROUP BY status, reason_for_visit
ORDER BY status, sum DESC;
```

Data output:

Row	sum	status	reason_for_visit
1	15	Cancelled	Consultation
2	10	Cancelled	Follow-up
3	10	Cancelled	Therapy
4	8	Cancelled	Checkup
5	8	Cancelled	Emergency
6	16	Completed	Checkup
7	12	Completed	Follow-up
8	9	Completed	Therapy
9	5	Completed	Emergency
10	4	Completed	Consultation
11	15	No-show	Therapy
12	11	No-show	Consultation
13	10	No-show	Emergency
14	10	No-show	Checkup
15	6	No-show	Follow-up
16	13	Scheduled	Follow-up
17	13	Scheduled	Consultation
18	11	Scheduled	Checkup
19	8	Scheduled	Therapy
20	6	Scheduled	Emergency

```sql
-- what is the percentage for each status of appointments (cancelled,
no-show, completed, scheduled appointments)?
SELECT status, count(*) as total_no_of_appointments,
round(count(*)*100/200,0) as percentage
FROM `utility-span-484509-m6.hospital_management.patients` as p
JOIN `utility-span-484509-m6.hospital_management.appointments`as a
ON p.patient_id = a.patient_id
GROUP BY status
-- cancelled, scheduled, no-show = 26% each, completed = 23%
```

Row	status	total_no_of_appo...	percentage
1	Cancelled	51	26.0
2	Scheduled	51	26.0
3	Completed	46	23.0
4	No-show	52	26.0

<Cancelled Patient demographic> Input:

Finding out the patient demographic for status ‘No-show’ and ‘Cancelled’ from patient and appointments joint table

My code:

```
-- What is the patient demographic of cancelled appointments?
SELECT status, p.patient id, date of birth, gender, registration_date
FROM `utility-span-484509-m6.hospital_management.patients`  as p
LEFT JOIN `utility-span-484509-m6.hospital_management.appointments` as a
ON p.patient_id = a.patient_id
WHERE status = 'Cancelled'
ORDER BY date_of_birth
-- Total number of cancelled appointments = 51, F =25, M =26, (F=49%, M=51%)
-- 1995-2005=12 (20s=24%), 1985-1995=20 (39%), 1975-1985=6 (12%), 1965-1975=7
(14%), 1955-1965=2 (4%), 1945-1955=4 (8%)
```

Snippet of the data output:

Cancelled	P039	1950/12/12	F	2021/03/09
Cancelled	P041	1951/06/19	M	2022/07/16
Cancelled	P022	1955/05/10	M	2021/05/11
Cancelled	P001	1955/06/04	F	2022/06/23
Cancelled	P030	1964/12/23	M	2021/08/07
Cancelled	P045	1966/04/25	F	2021/01/23
Cancelled	P025	1966/08/14	M	2021/09/09
Cancelled	P025	1966/08/14	M	2021/09/09
Cancelled	P011	1966/12/04	F	2022/09/27
Cancelled	P014	1968/02/27	M	2023/12/12
Cancelled	P033	1970/02/06	F	2023/09/06
Cancelled	P009	1971/12/11	M	2022/09/18
Cancelled	P019	1975/05/24	M	2023/06/24
Cancelled	P019	1975/05/24	M	2023/06/24
Cancelled	P044	1976/03/11	F	2023/01/26
Cancelled	P044	1976/03/11	F	2023/01/26
Cancelled	P043	1980/03/25	M	2022/07/18
Cancelled	P048	1983/03/24	M	2023/06/19
Cancelled	P002	1984/10/12	F	2022/01/15
Cancelled	P046	1986/09/01	F	2021/07/31
Cancelled	P046	1986/09/01	F	2021/07/31
Cancelled	P031	1987/01/14	M	2022/06/28
Cancelled	P007	1989/06/08	F	2021/12/25
Cancelled	P007	1989/06/08	F	2021/12/25
Cancelled	P007	1989/06/08	F	2021/12/25
Cancelled	P013	1990/03/28	F	2021/12/23
Cancelled	P017	1991/05/01	M	2022/09/26

Link to full data set:

https://docs.google.com/spreadsheets/d/1LrkhfU7BaY6B0zggZMIMqqAKEVZoLPQkPfp48JvFIfY/edit?usp=sharing

<No-Show Patient Demographic> Input:

My Code:

```
-- What is the patient demographic of no-show appointments?
SELECT status, p.patient_id, date_of_birth, gender, registration_date
FROM `utility-span-484509-m6.hospital_management.patients` as p
LEFT JOIN `utility-span-484509-m6.hospital_management.appointments`as a
ON p.patient_id = a.patient_id
WHERE status = 'No-show'
ORDER BY date_of_birth
-- Total number of no-show appointments =52, F=17, M=35, (F=33%, M=67%)
-- No-show total = 52,  date_of_birth before 1995 (age 30+)=42, after
1995(age 20 - 30)=10, (30+ =81%, 20-30=19%)
-- 1985-1995 = 12, 1975-1985=7, 1965-1975=10, 1955-1965=8, 1945-1955=5
(20s=19%, 30s=23%, 40s=13%, 50s=19%, 60s=15%, 70s=9%)
```

Snippet of the data output:

status	patient_id	date_of_bi	gender	registratio
No-show	P034	1950/01/26	F	2023/06/18
No-show	P039	1950/12/12	F	2021/03/09
No-show	P039	1950/12/12	F	2021/03/09
No-show	P039	1950/12/12	F	2021/03/09
No-show	P042	1954/08/22	F	2022/03/15
No-show	P022	1955/05/10	M	2021/05/11
No-show	P022	1955/05/10	M	2021/05/11
No-show	P001	1955/06/04	F	2022/06/23
No-show	P005	1960/06/23	M	2021/09/29
No-show	P005	1960/06/23	M	2021/09/29
No-show	P005	1960/06/23	M	2021/09/29
No-show	P005	1960/06/23	M	2021/09/29
No-show	P030	1964/12/23	M	2021/08/07
No-show	P045	1966/04/25	F	2021/01/23
No-show	P025	1966/08/14	M	2021/09/09
No-show	P033	1970/02/06	F	2023/09/06
No-show	P033	1970/02/06	F	2023/09/06

Link to full data set:
https://docs.google.com/spreadsheets/d/1QrD4WDmjFjoLd9M45JNVvetBHGc-YlQ_CXHonUMFkpw/edit?usp=sharing