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INTRODUCTION

The purpose of this item of work is to provide a scoring model that will assist business in scheduling appointments based on a particular set of parameters. The scoring model (titled: Equity Adjustor) is depended on pre-defined as well as calculated parameters derived from selected dimensions and facts. For demonstration purposes, this document references model developed and used by **surgical services**.

The rationale behind the tool is to develop an algorithm that prioritises patients by clinical priority first (highest relative score- see Fig 2), supported by weightages for other parameters.

MODEL PARAMETERS

The formula used to calculate the Equity Adjustor Score for Surgical Waitlist is dependent on below measures, pre-defined weightages and scores:

1. **Starting Score** = Based on Clinical Priority (P1-4) and Ethnicity (Maori, Pacific, Other) based patient cohorts by service. Need to look at acceptable booking thresholds against priority level and ethnicity.
2. **Days Waiting** = As at date **minus** Date Added to waitlist
3. **Secondary Score Start Date** = Based on weightage split by priority (P1 – P4) and ethnicity by each service level.
4. **Deprivation Index** = Sourced from census (1 – 10)
5. **DI Starting Score** = Starting score of 0 with each day on waiting list adds 1 to the score
6. **Remote Location** = Based on DHB (IF DHB IN (AKL, Manukau, Waitemata) THEN 0 ELSE 20)
7. **Per Day primary** = Derived from Target Days by priority and ethnicity patient cohorts.
8. **Per Day secondary** = Derived from Target Days by priority and ethnicity patient cohorts.

PROCESS WITH MAPPING TABLES & CODED CALCULATION

Process guide:

1. Group service codes into P1-P4 Priorities with P1 being Urgent and P4 being Routine

code	service	priority
CC	Gynaecology	P1
HSC	Gynaecology	P1
H-Urgent	Paediatric Cardiac & ICU's	P1
Urgent	Paediatric Gastroenterology	P1
P1-Inpat	Cardiothoracic	P1
Immediate	Urology	P1
P2-Urgent	Paediatric Cardiac	P1
P1-Acute	Cardiology	P1
Sem-urgent	Cardiothoracic	P2
P3-SemiUrg	Paediatric Cardiac	P2
P2-OutP30	Cardiothoracic	P2
O-SemiUrg	Paediatric Cardiac & ICU's	P2

Fig1: Definitions: Priority groups

- Set up mapping tables containing Starting Score, Per Day Primary, Per Day Secondary and Secondary Score Start Day calculated and defined by ethnicity and priority based patient cohorts against each service. These parameters can be defined based on historical estimated wait times against priority levels and ethnicity and/or accepted thresholds for each group

CURRENT PARAMETERS						
SCENARIO 2						
		Index	Starting Score	per day (primary)	per day (secondary)	secondary scoring start day
M	P1	M-P1	250	2.2	9	10
M	P2	M-P2	160	1.6	7	36
M	P3	M-P3	60	1.4	4	70
M	P4	M-P4	10	1	2	100
PI	P1	PI-P1	250	2.2	8	10
PI	P2	PI-P2	155	1.4	6.6	36
PI	P3	PI-P3	55	1.2	3.5	70
PI	P4	PI-P4	5	0.8	2	100
O	P1	O-P1	250	1	7	10
O	P2	O-P2	150	0.6	4	36
O	P3	O-P3	50	0.5	2	90
O	P4	O-P4	0	0.3	1	150
A	Deprivation_Index	A-Deprivation_Index	0	1	1	
A	Remote_Location	A-Remote_Location	20	0	0	

Fig 2: Parameters- Clinical, Ethnicity & other

- Load mapping tables into system with all the above-required fields
- Note: for Urology uses CPAC score as part of their equity calculations against waitlist. Need to incorporate CPAC into Equity tool
- The grouped priorities are mapped with booking elective table based on ethnicity and CBU and below additional fields are calculated and added to the booking elective table:
 - Primary days waiting
 - Secondary days waiting

Sample Code:

CASE

WHEN

I_map_pro_equity_prioritisation.Secondary_Score_Start_Day <=
s_booking_elective_1.DaysWaiting

THEN

I_map_pro_equity_prioritisation.Secondary_Score_Start_Day-1

ELSE

s_booking_elective_1.DaysWaiting END AS Primary_days_waiting

,

CASE

WHEN

```
I_map_pro_equity_prioritisation.Secondary_Score_Start_Day
<= s_booking_elective_1.DaysWaiting
```

THEN

```
(s_booking_elective_1.DaysWaiting -
I_map_pro_equity_prioritisation.Secondary_Score_Start_Day)+ 1
```

ELSE

```
0
```

END AS Secondary_days_waiting

6. The final score is then calculated based on mapped and existing fields by Ethnicity, priority and CBU in booking_elective table

Sample Code:

```
Starting_Score +
(Primary_days_waiting * Per_Day_Primary) +
(Secondary_days_waiting * Per_Day_Secondary) +
(CASE
    WHEN DeprivationScale = 0
    THEN 0
    ELSE (((DeprivationScale-1)*1.0)/50)* DaysWaiting
END) +
(CASE
    WHEN DHBDesc NOT IN ('Auckland', 'Counties Manukau', 'Waitemata','Unknown')
    THEN 20
    ELSE 0
END)
```

EXAMPLE 1 – (M-P1)

Taking first record from table below as an example with Ethnicity being Maori and Priority code P1. Based on model we join Ethnicity code with Grouped Priority Code to define Index column (M-P1).

M-P1:

- For M-P1, first row example highlighted in table below, the **Starting Score** is 250 as defined by acceptable threshold and historical wait times analyses
- We then add **Per day (primary)** 2.2 points for everyday on waiting list up to 9 days (last day before Secondary Score start day) in 250 Starting Score
 - The Score will be **250 + (2.2*9) = 269.8** at this stage
- Then we will add **Per day (secondary)** 9 points per day from day 10 onwards (as per Secondary Score Start day) for each day on waiting list in above score
 - The Priority Score will be **P = 269.8 + (9* however many days the patient is or will be in waitlist)**
- We will then add Deprivation Index (DI) to the above calculation

- If the DI for a location against domicile is 0 then we will add 0 to above calculation
- Else we will divide **Deprivation index** by 50 and multiple with each additional day in waiting list with a starting score of 1 for first day in the waiting list
 - $P = P + (((0 - 1 + DI)/50) * \text{Days in Waiting List})$
- Final step, we will add **Remote location** score of 20 against any location outside of 'Auckland', 'Counties Manukau', 'Waitemata'. For locations within these DHBs, the Remote Location score will be 0
- The above steps/calculations will provide Equity Adjustor Score for M-P1

CURRENT PARAMETERS							
Ethnicity Code	Ethnicity	Priority Code	Index	Starting Score	per day (primary)	per day (secondary)	secondary scoring start day
M	Maori	P1	M-P1	250	2.2	9	10
M	Maori	P2	M-P2	160	1.6	7	36
M	Maori	P3	M-P3	60	1.4	4	70
M	Maori	P4	M-P4	10	1	2	100
PI	Pacific	P1	PI-P1	250	2.2	8	10
PI	Pacific	P2	PI-P2	155	1.4	6.6	36
PI	Pacific	P3	PI-P3	55	1.2	3.5	70
PI	Pacific	P4	PI-P4	5	0.8	2	100
O	Other	P1	O-P1	250	1	7	10
O	Other	P2	O-P2	150	0.6	4	36
O	Other	P3	O-P3	50	0.5	2	90
O	Other	P4	O-P4	0	0.3	1	150

A	All	Deprivation_Index	A-Deprivation_Index	0	1	1	
A	All	Remote_Location	A-Remote_Location	20	0	0	

Fig 3: Example of parameter setting

Days Waiting	Weeks Waiting	NC Month	Ethnicity	Priority Code	Secondary Start	Deprivation Index	Remote Location	Ethnicity & Priority			Deprivation Index		Remote Location		Day One Score	SCORE
								Starting Score	per day (primary)	per day (secondary)	Starting Score	per day	Starting Score	per day		
436	63	01/09/2021	M	P2	36	9	1	160	1.6	7	0	1	20	0	180	3112.8
655	94	01/02/2021	O	P2	36	9	0	150	0.6	4	0	1	20	0	150	2755.8
344	50	01/12/2021	M	P2	36	9	0	160	1.6	7	0	1	20	0	160	2434
522	75	01/06/2021	M	P3	70	2	0	60	1.4	4	0	1	20	0	60	1979
494	71	01/07/2021	M	P3	70	9	0	60	1.4	4	0	1	20	0	60	1935.6
553	79	01/05/2021	PI	P3	70	8	0	55	1.2	3.5	0	1	20	0	55	1909.2
268	39	01/03/2022	PI	P2	36	3	0	155	1.4	6.6	0	1	20	0	155	1752.5
415	60	01/10/2021	O	P2	36	4	1	150	0.6	4	0	1	20	0	170	1735.9
442	64	01/09/2021	M	P3	70	3	0	60	1.4	4	0	1	20	0	60	1666.3
393	57	01/11/2021	O	P2	36	6	0	150	0.6	4	0	1	20	0	150	1642.3
177	26	01/03/2022	PI	P1	10	9	0	250	2.2	8	0	1	20	0	250	1642.1
414	60	01/10/2021	M	P3	70	10	0	60	1.4	4	0	1	20	0	60	1611.1

Fig 4: Sample table with a breakdown of each parameter used for calculating the EA Score for Surgical

The above sample table shows the breakdown of each parameter used for calculating the Equity Adjustor Score for Surgical based on the model defined above. So for first row M-P2 the priority score is 3112.8 based on calculations/steps defined above.

$$P = 160 + (1.6 * 35) + (7 * (436 - 35)) + (((0 - 1 + 9) / 50) * 436) + (20 * 1) = 3112.8$$

SCREENSHOTS - DB TABLES

[DSUMaintained].[dbo].[map_pro_equity_prioritisation]

ID	Service	Ethnicity Prioritised Group	Priority Code	Index	Starting Score	Per Day Primary	Per Day Secondary	Secondary Score Start Day	Source	StartDate	EndDate	CurrentFlag
1	24HC	Maori	P1	M-P1	1500.00	2.20	12.00	10	Surgical	2022-09-09 00:00:00.000	9999-12-31 00:00:00.000	1
2	24HC	Maori	P2	M-P2	1060.00	1.60	10.00	36	Surgical	2022-09-09 00:00:00.000	9999-12-31 00:00:00.000	1
3	24HC	Maori	P3	M-P3	240.00	1.40	8.00	70	Surgical	2022-09-09 00:00:00.000	9999-12-31 00:00:00.000	1
4	24HC	Maori	P4	M-P4	10.00	1.00	8.00	100	Surgical	2022-09-09 00:00:00.000	9999-12-31 00:00:00.000	1
5	A Plus Links	Maori	P1	M-P1	1500.00	2.20	12.00	10	Surgical	2022-09-09 00:00:00.000	9999-12-31 00:00:00.000	1
6	A Plus Links	Maori	P2	M-P2	1060.00	1.60	10.00	36	Surgical	2022-09-09 00:00:00.000	9999-12-31 00:00:00.000	1
7	A Plus Links	Maori	P3	M-P3	240.00	1.40	8.00	70	Surgical	2022-09-09 00:00:00.000	9999-12-31 00:00:00.000	1
8	A Plus Links	Maori	P4	M-P4	10.00	1.00	8.00	100	Surgical	2022-09-09 00:00:00.000	9999-12-31 00:00:00.000	1
9	A Plus Networks	Maori	P1	M-P1	1500.00	2.20	12.00	10	Surgical	2022-09-09 00:00:00.000	9999-12-31 00:00:00.000	1
10	A Plus Networks	Maori	P2	M-P2	1060.00	1.60	10.00	36	Surgical	2022-09-09 00:00:00.000	9999-12-31 00:00:00.000	1
11	A Plus Networks	Maori	P3	M-P3	240.00	1.40	8.00	70	Surgical	2022-09-09 00:00:00.000	9999-12-31 00:00:00.000	1
12	A Plus Networks	Maori	P4	M-P4	10.00	1.00	8.00	100	Surgical	2022-09-09 00:00:00.000	9999-12-31 00:00:00.000	1
13	ACC	Maori	P1	M-P1	1500.00	2.20	12.00	10	Surgical	2022-09-09 00:00:00.000	9999-12-31 00:00:00.000	1
14	ACC	Maori	P2	M-P2	1060.00	1.60	10.00	36	Surgical	2022-09-09 00:00:00.000	9999-12-31 00:00:00.000	1
15	ACC	Maori	P3	M-P3	240.00	1.40	8.00	70	Surgical	2022-09-09 00:00:00.000	9999-12-31 00:00:00.000	1
16	ACC	Maori	P4	M-P4	10.00	1.00	8.00	100	Surgical	2022-09-09 00:00:00.000	9999-12-31 00:00:00.000	1
17	ACH Administration	Maori	P1	M-P1	1500.00	2.20	12.00	10	Surgical	2022-09-09 00:00:00.000	9999-12-31 00:00:00.000	1
18	ACH Administration	Maori	P2	M-P2	1060.00	1.60	10.00	36	Surgical	2022-09-09 00:00:00.000	9999-12-31 00:00:00.000	1

Fig 5: Screenshot 1

dbo.fact_booking_elective

dim_referral_reason_key	dim_referrer_type_key	dim_reason_list_key	dim_requested_date_key	dim_specialty_key	dim_waitlisted_date_key	dim_surgery_timebox_date_key	dim_ward_key	dss_update_time	IShortNotice	ProEquityScore
395600	21	23	19980928	16	0	0	0	2023-02-08 02:06:05.573	0	1667.90
395600	21	1	19980908	25	0	19990424	0	2023-02-08 02:06:05.573	0	2629.48
395600	21	1	19980618	25	0	19990222	0	2023-02-08 02:06:05.573	0	2787.24
395600	21	1	19981130	16	0	19990211	0	2023-02-08 02:06:05.573	0	1498.96
395600	21	28	19980908	25	0	0	0	2023-02-08 02:06:05.573	0	2617.68
395600	21	1	19980707	23	0	19990418	0	2023-02-08 02:06:05.573	0	2994.62
395600	21	1	19980908	25	0	0	0	2023-02-08 02:06:05.573	0	1060.00
395600	21	1	19980921	16	0	19990125	0	2023-02-08 02:06:05.573	0	1831.80
395600	21	31	19980921	25	0	0	0	2023-02-08 02:06:05.573	0	1922.88
395600	21	1	19980908	25	0	19990526	0	2023-02-08 02:06:05.573	0	2882.20
395600	21	1	19980921	16	0	19990125	0	2023-02-08 02:06:05.573	0	1821.00
395600	21	1	19980629	25	0	0	0	2023-02-08 02:06:05.573	0	1030.00
395600	21	1	19980911	23	0	19990516	0	2023-02-08 02:06:05.573	0	2688.85
395600	21	1	19980921	16	0	19990125	0	2023-02-08 02:06:05.573	0	1823.70
395600	21	1	19980921	16	0	19990125	0	2023-02-08 02:06:05.573	0	1839.90
395600	21	1	19980908	25	0	19990424	0	2023-02-08 02:06:05.573	0	2634.12
20577	21	1	19980921	16	0	19990125	0	2023-02-08 02:06:05.573	0	1834.50
395600	21	1	19980618	25	0	0	0	2023-02-08 02:06:05.573	0	1030.00
395600	21	1	19980921	16	0	19981221	0	2023-02-08 02:06:05.573	0	2129.50
395600	21	1	19980707	23	0	0	0	2023-02-08 02:06:05.573	0	1030.00

Fig 6: Screenshot 2

Setting up the equity adjuster parameters

CREATE THE ENVIRONMENT	1	Ensure that each patient on the waitlist has an accurate priority score	This is the second most important factor in driving the scores (days waiting is the first). If the priorities are inaccurate, the tool will not deliver the desired outcomes.
	2	Check the Wait time guidelines for each priority group by service	The most common WT guidelines are P1: 14 Days, P2: 42 Days, P3: 84 Days, P4: depending on current directives (120 days under ESPI, 365 Days under Directive001, etc). These guidelines should be dictated by the likely time frame for patient deterioration. There may be a different scale by service.
	3	Start with the default scores	The default scores were set up during a period of significant waitlist growth and therefore may need significant adjustment depending on the size of the waitlist for each service. NOTE: The default score should be fully reviewed periodically (every 3-6 months, but with continual monitoring as per steps 9 & 10) and changed based on the condition of the waitlist at the time of review
	4	Identify the Booking threshold for each service	This should be set at the score of the nth percentile patient, where $n = 1 - (\text{capacity for patients within the booking horizon}) / (\text{Total patients on waitlist})$. I.e. total waitlist of 600 patients, and a capacity of 25 patients/week, with a booking horizon of 4 weeks. Therefore, there should be 100 patients booked at any given time. $100/600 = 17\%$, so the booking threshold should equal the score of the patient at the 83rd percentile (that will be the patient in 100th place in this example). If that patient has a score of 1250, and the tool is used exactly, all patients with a score of 1250+ should be booked each week. NOTE: This is a dynamic parameter. If you change the scoring parameters, the booking threshold will also change.
SET THE PARAMETERS	5	Look at where each cohort's trajectory hits the booking threshold	How does each trajectory compare to the WT guidelines in step 2? If patients are taking too many days to hit the booking threshold, consider adjusting their score. HOWEVER as in step 4, note carefully that changing scores will then move the booking threshold , potentially preventing other cohorts from meeting their WT guidelines... it is likely that in a number of services, there will not be a set of scores that achieve all guidelines.
	6	Look at where the overlaps are between cohorts	<ul style="list-style-type: none"> ➤ Are longer-waiting, lower-priority patients overtaking higher priority patients and preventing them from being booked within the clinical time frame ➤ Are short-waiting (i.e. less than 70% of WT guideline), higher-priority patients still scoring higher than long-waiting, lower-priority patients?
	7	Look at where the prioritised groups (initially focussed on Maori & Pacific patients) overlap the next 'P' group	<ul style="list-style-type: none"> ➤ Are we doing enough to address the pathway issues and inequities for these patients? ➤ Are these patients now scoring too fast and having a significant negative impact on the outcomes of higher 'P' group patients?
	8	Review with SCDs to ensure they are satisfied that the best balance of wait time across cohorts vs clinical guidelines is struck	The SCDs are responsible for clinical risk in their service, therefore these scores must be approved by them, including with full understanding of the compromises in step 5

REVIEW THE OUTCOMES	9	Review the average/median/90th percentile wait times of each cohort moving forwards	<ul style="list-style-type: none"> ➤ Are the relative wait times moving towards 'ideal' quickly enough? ➤ Have they moved past the 'ideal', inappropriately impacting other patients?
	10	Review the adherence to scoring in the booking priorities	<ul style="list-style-type: none"> ➤ Is the percentage of the bookings being made for the highest scoring patients acceptable? ('acceptable' will vary across services based on several factors including the level of sub-specialisation)
	11	Review and where necessary reset the scores by repeating steps 5-8	<p>If the answer to any of the three questions in steps 9 & 10 suggests a review is necessary:</p> <ul style="list-style-type: none"> ➤ First, determine whether the 'overrides' identified in step 10 are appropriate. If they are not, then the booking team needs to review their processes. ➤ If (1) the overrides are appropriate and identify issues in the scoring parameters, (2) the trends identified in step 9 are not as desired, and/or (3) it has been 6 months since the last review, then repeat steps 5-8

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