

Supplemental Appendix

Inequity in access to continuous glucose monitoring and health outcomes in paediatric diabetes, a case for national continuous glucose monitoring funding: A cross-sectional population study of children with type 1 diabetes in New Zealand.

List of Authors

Mercedes J. Burnside, MBChB.

Jonathan A. Williman, Ph.D.

Hannah M. Davies.

Craig A. Jefferies, M.D.

Ryan G. Paul, Ph.D.

Benjamin J. Wheeler, Ph.D.

Esko J. Wiltshire, MD.

Yvonne C. Anderson, Ph.D.

Martin I. de Bock, Ph.D.

Table of Contents	
List of Authors	2
Table of Contents	3
Supplemental Tables	4
Supplemental Table 1: Participant data recorded.	4
Supplemental Table 2: Description of study sample.	5
Supplemental Table 3: Associations between demographic and clinical factors with level of glycaemic control.	7
Supplemental Figures	9
Supplemental Figure 1: District Health Board territories in New Zealand.	9
Supplemental Figure 2: CGM use by District Health Board.	10
References	11

Supplemental Tables

Supplemental Table 1: Participant data recorded.

Participant demographic characteristics
Age in years Gender Ethnicity ^a Meshblock ^b
General diabetes information
Date of Type 1 Diabetes diagnosis ^c District Health Board (DHB) Glycated haemoglobin (HbA1c) ^d Insulin therapy (multiple daily injections, insulin pump therapy, automated insulin delivery) ^e
CGM information
CGM use (yes/no) ^f Type of CGM (intermittently scanned, or real time) How CGM is funded (self, Work and Income New Zealand (WINZ), DHB, research, other)
<p>^aThe spreadsheet allowed for the recording of up to six self-reported ethnicities per participant; however, participants were allocated to a single ethnic group for statistical output prioritised in the order of Māori, Pacific, Asian and European/Other, as per standard protocol (1).</p> <p>^bA meshblock (a small area code) was provided rather than participant address because it is de-identified. Meshblocks were used to generate New Zealand Index of Deprivation Scores (2018).</p> <p>^cDate of type 1 diabetes diagnosis was used to calculate age at diagnosis and duration of diabetes.</p> <p>^dLast recorded HbA1c in the six months between the 01 April 2021 - 01 October 2021. Glucose management indicator (GMI) was not used if a point of care/local laboratory HbA1c test was not available.</p> <p>^eInsulin pump therapy did not distinguish between standard pump therapy and sensor augmented pump therapy.</p> <p>^fCGM use was a binary (yes/no) outcome. No percent time in use definition was applied to “CGM use”.</p>

Supplemental Table 2: Description of study sample.

Demographics	
Age – no. (%)	N= 1209
< 5 yr	72 (6.0%)
5 to < 10 yr	372 (30.8%)
10 to < 15 yr	765 (63.2%)
Median (IQR)	11 (8, 13)
Gender – no. (%)	N= 1209
Female	607 (50.2%)
Ethnicity – no. (%) ^a	N= 1208
Māori	219 (18.1%)
Pacific	86 (7.1%)
Asian	55 (4.6%)
Middle Eastern/Latin American/African (MELAA)	22 (1.8%)
Other	21 (1.7%)
European	805 (66.6%)
New Zealand Deprivation Index (quintile) – no. (%) ^b	N= 1207
1 (least deprived)	279 (23.1%)
2	258 (21.4%)
3	230 (19.1%)
4	226 (18.7%)
5 (most deprived)	214 (17.7%)
Diabetes information	
Age at diagnosis, median (IQR)	N= 1208 5.9 (3.1, 8.8)
Duration of diabetes, median (IQR)	N= 1208 3.6 (1.5, 6.2)
District Health Board – no. (%)	N= 1209
Northland	43 (3.6%)
Waitemata	102 (8.4%)
Auckland	74 (6.1%)
Counties Manukau	115 (9.5%)
Waikato	108 (8.9%)
Bay of Plenty	59 (4.9%)
Taranaki	43 (3.6%)
Lakes	31 (2.6%)
Tairāwhiti	12 (1.0%)
Whanganui	23 (1.9%)
Mid Central	55 (4.5%)
Hawkes Bay	53 (4.4%)
Capital and Coast	70 (5.8%)
Hutt Valley	65 (5.4%)
Wairarapa	8 (0.7%)
Nelson/ Marlborough	39 (3.2%)
West Coast	13 (1.1%)
Canterbury	150 (12.4%)
South Canterbury	35 (2.9%)
Southern	111 (9.2%)
HbA1c, mmol/mol ^c	N= 1187
32 to < 53	175 (14.7%)
≥ 53	1012 (85.3%)
Median (IQR)	64 (56, 75)
Insulin modality – no. (%)	N= 1209
Injections	697 (57.7%)
Insulin pump ^d	484 (40.0%)
Automated insulin delivery	28 (2.3%)
CGM information	
Glucose monitoring modality – no. (%) ^e	N= 1203
Self-monitoring of blood glucose	392 (32.6%)
Intermittently scanned CGM	484 (40.2%)
Real time CGM	327 (27.2%)
How CGM funded – no. (%)	N= 778
Self	679 (87.3%)
Research	51 (6.6%)
Work and Income New Zealand (WINZ)	27 (3.5%)
Other	18 (2.3%)
DHB	3 (0.4%)
*Data are presented as n (%) unless otherwise indicated.	
** Waitemata, Auckland and Counties Manukau are three district health boards (DHBs) under a single regional diabetes service, and	

Canterbury and West Coast DHBs share a single regional diabetes service.

^aParticipants could select up to six ethnicities; however, they were allocated to a single ethnic group for statistical output prioritised in the order of Māori, Pacific, Asian, MELAA, other, European.

^bThe New Zealand deprivation index is an area-based measure of socioeconomic deprivation where quintile 5 represents the 20% most deprived areas in New Zealand.

^cLocal laboratory/point of care HbA1c, last recorded between 01 April 2021 and 01 October 2021.

^dInsulin pump includes standard pump therapy and sensor augmented pump therapy.

^eCGM use (real-time and intermittent) – a patient was regarded as “using” CGM irrespective of how often it was used.

Supplemental Table 3: Associations between demographic and clinical factors with level of glycaemic control.

Demographic Information	HbA1c, mmol/mol			
	Mean (SD)	Unadjusted difference (95% CI)	CGM adjusted difference (95% CI)	Fully adjusted difference (95% CI)
Age		<i>P</i> < 0.001	<i>P</i> = 0.004	<i>P</i> < 0.001
< 5 yr	63.2 (15.9)	0	0	0
5 to < 10 yr	64.1 (14.3)	0.9 (-4.0, 5.8)	-0.1 (-4.8, 4.5)	-1.7 (-6.1, 2.8)
10 to < 15 yr	68.2 (16.5)	5.0 (0.3, 9.7)	3.1 (-1.3, 7.5)	2.3 (-2.1, 6.7)
Gender		<i>p</i> = 0.209	<i>p</i> = 0.188	<i>p</i> = 0.074
Female	67.3 (16.4)	0	0	0
Male	66.1 (15.6)	-1.2 (-3.1, 0.7)	-1.2 (-3.0, 0.6)	-1.5 (-3.2, 0.1)
New Zealand Deprivation Index (quintile)		<i>P</i> < 0.001	<i>P</i> < 0.001	<i>P</i> = 0.012
1 (least deprived)	62.0 (12.5)	0	0	0
2	64.5 (14.4)	2.5 (-0.9, 5.9)	1.6 (-1.7, 4.9)	1.4 (-1.7, 4.5)
3	64.4 (14.0)	2.4 (-1.1, 6.0)	1.3 (-2.1, 4.8)	0.6 (-2.6, 3.9)
4	69.3 (18.1)	7.3 (3.8, 10.9)	4.7 (1.2, 8.2)	2.8 (-0.7, 6.2)
5 (most deprived)	75.0 (17.9)	13.0 (9.4, 16.7)	9.1 (5.4, 12.7)	5.2 (1.5, 9.0)
Diabetes Information				
Duration of diabetes		<i>P</i> = 0.002	<i>P</i> = 0.002	<i>P</i> < 0.001
< 2 yr	63.6 (15.6)	0	0	0
2 to < 4 yr	67.6 (16.3)	3.9 (0.9, 7.0)	3.6 (0.7, 6.4)	4.0 (1.2, 6.7)
4 to < 15 yr	67.7 (15.9)	4.0 (1.4, 6.7)	3.9 (1.4, 6.4)	4.8 (2.2, 7.3)
Insulin modality		<i>p</i> < 0.001	<i>p</i> < 0.001	<i>p</i> < 0.001
Insulin injections	70.5 (17.8)	0	0	0
Insulin pump	62.4 (12.0)	-8.1 (-10.2, -6.0)	-4.3 (-6.6, -2.0)	-4.9 (-7.3, -2.6)
Automated insulin delivery	57.0 (9.4)	-13.5 (-20.4, -6.6)	-7.2 (-14.1, -0.3)	-8.2 (-14.9, -1.4)
District Health Board		<i>P</i> < 0.001	<i>P</i> < 0.001	<i>P</i> = 0.002

Northland	73.4 (17.3)	5.9 (-2.7, 14.4)	3.5 (-4.6, 11.7)	1.4 (-6.4, 9.1)
Waitemata	66.2 (17.9)	-1.6 (-6.9, 3.6)	-2.4 (-7.4, 2.6)	-1.3 (-6.1, 3.5)
Auckland	63.9 (16.4)	-4.1 (-10.1, 1.9)	-5.1 (-10.8, 0.6)	-4.2 (-9.7, 1.2)
Counties Manukau	73.1 (18.5)	5.6 (0.6, 10.6)	2.6 (-2.3, 7.5)	1.2 (-3.7, 6.1)
Waikato	65.3 (17.0)	-2.6 (-7.8, 2.6)	-2.6 (-7.5, 2.3)	-3.3 (-8.0, 1.4)
Bay of Plenty	68.3 (16.8)	0.6 (-6.4, 7.5)	2.0 (-4.6, 8.6)	1.8 (-4.5, 8.0)
Taranaki	69.6 (13.5)	1.9 (-6.0, 9.8)	1.6 (-5.9, 9.0)	1.3 (-5.8, 8.4)
Lakes	73.9 (22.6)	6.5 (-2.6, 15.6)	6.5 (-2.1, 15.2)	3.6 (-4.6, 11.8)
Tairāwhiti	74.9 (9.8)	7.5 (-7.5, 22.5)	6.9 (-7.3, 21.2)	2.5 (-11.1, 16.0)
Whanganui	74.4 (16.2)	7.0 (-3.5, 17.4)	5.2 (-4.7, 15.1)	3.7 (-6.0, 13.5)
Mid Central	66.2 (17.7)	-1.7 (-8.6, 5.3)	-2.5 (-9.1, 4.1)	-2.0 (-8.3, 4.2)
Hawkes Bay	76.1 (16.4)	8.7 (1.5, 15.9)	7.4 (0.5, 14.2)	5.6 (-0.9, 12.1)
Capital and Coast	64.3 (12.6)	-3.7 (-9.8, 2.5)	-3.2 (-9.0, 2.6)	-2.0 (-7.5, 3.5)
Hutt Valley	64.6 (11.8)	-3.4 (-9.9, 3.1)	-2.8 (-9.0, 3.4)	-2.4 (-8.2, 3.5)
Wairarapa	61.6 (12.1)	-6.6 (-24.4, 11.3)	-2.5 (-19.5, 14.4)	-1.5 (-17.7, 14.8)
Nelson/ Marlborough	65.5 (12.8)	-2.4 (-10.3, 5.5)	-1.7 (-9.2, 5.8)	0.0 (-7.1, 7.1)
West Coast	65.2 (14.9)	-2.8 (-16.0, 10.4)	-0.9 (-13.5, 11.6)	1.3 (-11.1, 13.7)
Canterbury	60.8 (12.4)	-7.4 (-11.8, -2.9)	-7.1 (-11.3, -2.9)	-6.0 (-10.0, -1.9)
South Canterbury	64.9 (11.1)	-3.1 (-11.6, 5.5)	-2.3 (-10.4, 5.8)	0.9 (-7.0, 8.8)
Southern	63.7 (13.2)	-4.3 (-9.3, 0.8)	-2.5 (-7.4, 2.3)	-0.5 (-5.2, 4.1)

* An interaction effect was found between ethnicity and continuous glucose monitoring (CGM); therefore, results for ethnicity and CGM use are presented separately in Table 2.

** CGM adjusted differences are adjusted for CGM use (self-monitoring of blood glucose, intermittently scanned CGM, or real time CGM). Fully adjusted differences are adjusted for age, gender, ethnicity, deprivation, duration of diabetes, district health board, insulin modality, and CGM use.

*** The reference category for district health board is all 'other district health boards.'

**** Waitemata, Auckland and Counties Manukau are three district health boards under a single regional diabetes service, and Canterbury and West Coast are two district health boards under a single regional diabetes service.

***** Insulin pump therapy includes both standard pump therapy and sensor augmented pump therapy.

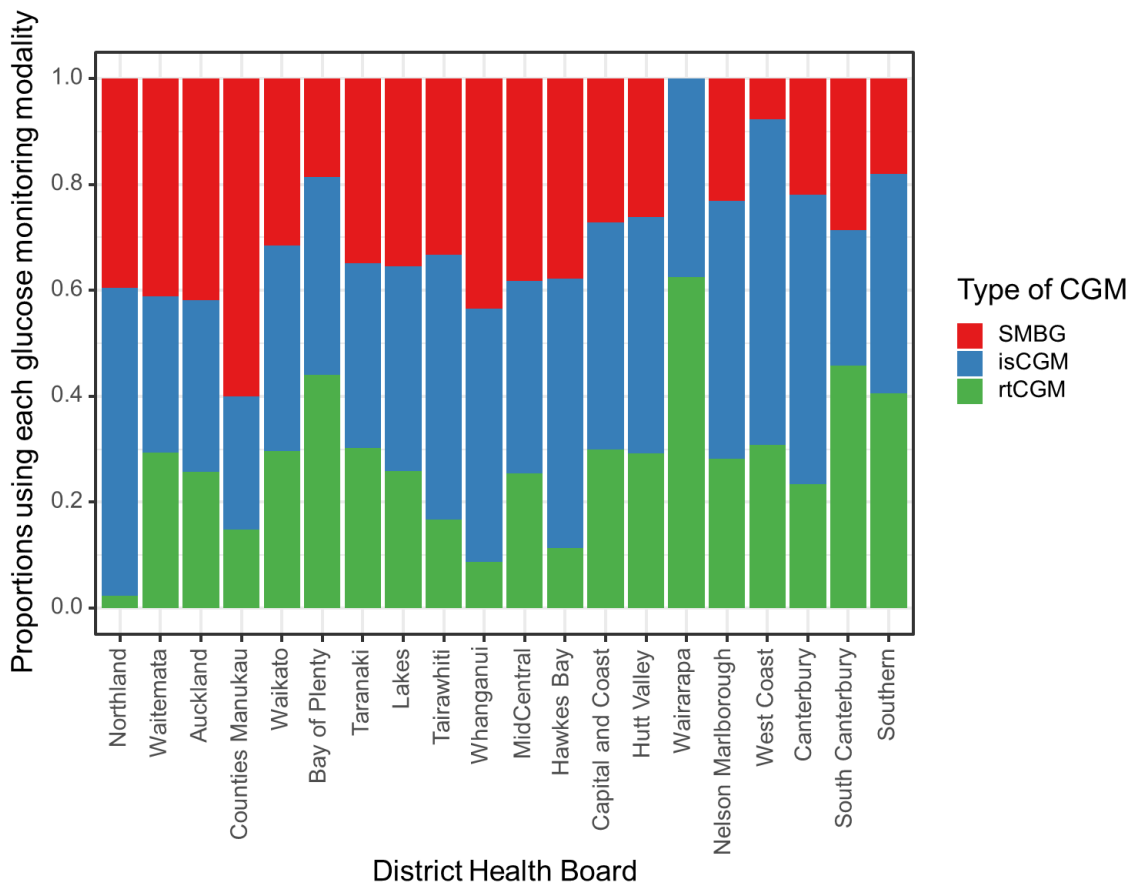
Supplemental Figures

Supplemental Figure 1: District Health Board territories in New Zealand.



Supplemental Figure 1: Map showing the 20 District Health Boards in New Zealand and their boundaries.

Supplemental Figure 2: CGM use by District Health Board.



Supplemental Figure 2: CGM use by District Health Board.

Coloured filled bars represent unadjusted proportions of children <15 years with type 1 diabetes using intermittently scanned continuous glucose monitoring (isCGM), real time continuous glucose monitoring (rtCGM), or self-monitoring of blood glucose (SMBG) at each district health board (DHB) in New Zealand. DHBs are listed by location in order of North to South. Waitemata, Auckland, and Counties Manukau DHBs represent a single regional diabetes service, and Canterbury and West Coast represent a single regional diabetes service.

References

1. Ministry of Health. 2017. HISO 10001:2017 Ethnicity Data Protocols. Wellington: Ministry of Health.