



## **eGrowth Chart** **User Guide in ABUHB**

### **Introduction**

CCube Solutions and ABUHB have developed a facility for recording and graphically displaying point data for patients – height, weight, and head circumference measurements, and BMI calculation.

The Growth Chart is an independent application that is linked into CWS, but fully integrated into patient electronic records; access is controlled by ABUHB from the NADEX login.

### **What does it do?**

It allows the creation of an electronic growth chart for all children who are registered in ABUHB, viewable by all CWS users, and data can be added from any location in ABUHB. Data entry and modification is however only allowed by users who have received appropriate training, both in the use of the CWS application, and the skill of clinical measurement.

The following combined charts can be viewed by all users:

- 0-2 Year chart for boys and girls displaying height, weight, head circumference
- 0-4 Year charts for boys and girls displaying height and weight
- 0-18 Year charts for boys and girls displaying height and weight

Charts are also available for BMI , and at each age range displaying a single growth parameter.

Charts can be switched to a background display for Down syndrome.

As default, the height, weight and head circumference data are displayed on a background centile graphs derived from the LMS data (see Appendix) for children, from the age of “term”. The charts do not display preterm growth. It is possible to display the data with a correction for preterm gestation.

There are additional options for displaying bone age, and target height range derived from parental height.

The following information can be recorded for a patient

- |                                     |                                 |
|-------------------------------------|---------------------------------|
| - Height in centimetres             | - Bone age in years             |
| - Weight in kilograms               | - Parents height in centimetres |
| - Head Circumference in centimetres | - Preterm Gestation             |

The system will calculate:

- |  |   |
|--|---|
| - BMI                                    | - Z (standard deviation) score            |
| - Height velocity - centimetres per year | - Target height range from parents height |

**Accessing application**

First log into CWS, select a patient and click the Growth Chart button, which appears as a subsidiary link to the Documents button.



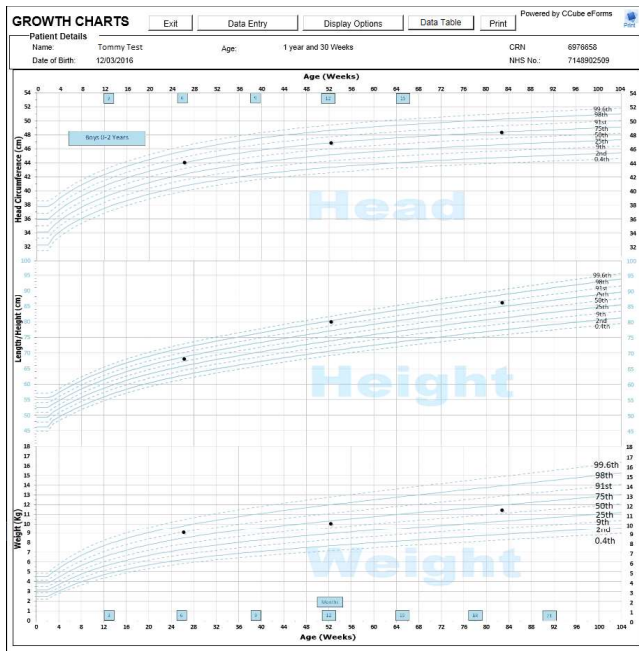
There are three levels of access

- Level 1.** Viewing only. The growth chart is viewable by all CWS users for children up to 18 years of age. A table can also be shown with all recorded measurements and calculations. At this level there is no ability to add, or change data.
- Level 2.** Viewing, as above plus ability to add Height, Weight and Head Circumference.
- Level 3.** Viewing and ability to enter, and change measurements - plus, parental height, bone age and premature gestation.

**How to use the application**

As the Growth Chart is integrated into CWS, the patient information, and NADEX ID of the user are passed to the application automatically. The application will go directly to the relevant chart based on the patients age and sex. If related information has been previously added it will default to Down Syndrome, or show gestation correction.

The screenshot below shows a 0-2 year Boy chart viewed by a user with Level 2 or 3 access. The Data Entry button is not visible in Level 1 access.



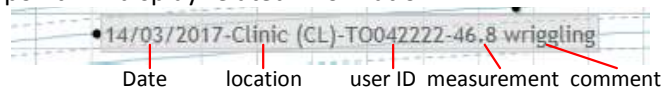
If any (previous) data exists for the patient, it will be plotted on the chart. As this is the 0-2 Year chart, it is displaying weight (at bottom), height (in the middle) and head circumference (at the top).

From this screen the user can select: **Data Entry** for adding more recordings or select **Display Options** for changing display **Data Table** for showing the numeric data

The initial display will not show Bone Age or target height.

The chart can be changed in size using the Ctrl + and Ctrl - function

Hovering over any data point will display related information:



**Viewing the Data Table**

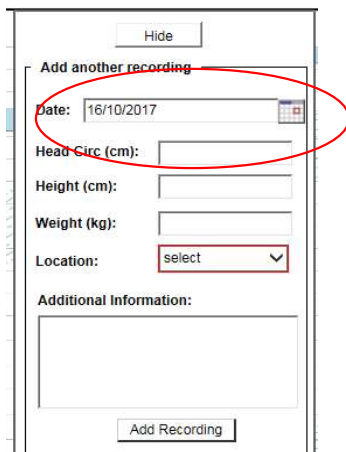
Select DATA TABLE button at the top of the screen and this table is displayed in a click/drag movable box superimposed on the chart, showing measurements and calculations.

Select	HospNo	Age	Date	Height (Z)	Weight (Z)	Head Circ (Z)	BMI	Ht. Vel	Bone Age	Location	UserID
<input checked="" type="radio"/>	6926762	3 y and 28 W	2017-11-16	99 (-0.4)	15 (-0.3)	52 (1.4)	15.3	7.98		CL	TO042222
<input type="radio"/>	6926762	2 y and 1 W	2016-05-16	87 (-0.3)	12.5 (0.1)	50.5 (1.5)	16.51	10.85		WA*	TO042222
<input type="radio"/>	6926762	1 y and 1 W	2015-05-12	76 (-0.4)	10.2 (0.3)	47.5 (0.9)	17.66			WA*	TO042222


Z (standard deviation) score is shown alongside measurement.  
 An asterisk (\*) by location means it is a retrospective entry.  
 No changes of data can be made in this view of the data table.

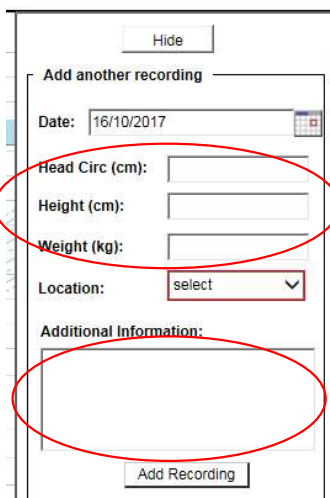
**Adding a new recording**

Select DATA ENTRY button at the top of the screen. The background display will default to the appropriate combined chart background, if not already there.



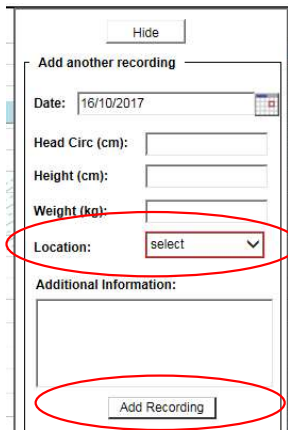
**Step 1:** Select a date for the recording. This date will be used to calculate the age of the patient. The default is the day's date. Retrospective data can be added selecting the date from the calendar icon

Press the calendar icon  and select the date from the pop-up calendar.

**Step 2:** Enter the weight and/or height and/or head circumference for this recording.

**Step 3:** If required enter any comment regarding the measurement process (e.g. "child very unsettled" or "weighed in mum's arms")



**Step 3:** Select the location where the recording was made. **This is mandatory.**

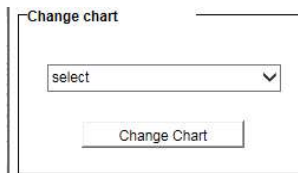
**Step 4:** Once you are happy with your entries, select the **ADD RECORDING** button – only shown if location has been entered.

Please confirm you have checked the data point. Do you want to keep or remove it?

**Step 5:** Your recording is now displayed on the chart. **Check it is correct.** You are given an opportunity to accept or reject this recording. Select the appropriate button.

**Changing the chart display**

You can change the chart that is displayed by using the ‘**Change chart**’ option which is available on selecting the DISPLAY OPTIONS button.

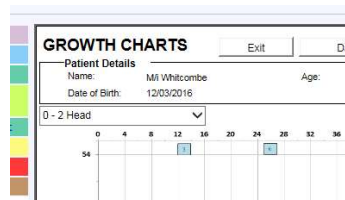


Select the appropriate chart from the drop down list and select **Change Chart**.

- select
- 0 to 2 years
- 0 to 4 years
- 0 to 18 years
- Single measurement
- BMI Chart

The appropriate chart will be displayed with the available data for the patient.

**Single measurement** selection defaults to 0-2 Head circumference, but this can then be changed to any age range or measurement from the box at the top left of the chart.



**Displaying additional data**

**Display on Chart**


Display recordings with gestation period correction  Yes  No

Display bone age  Yes  No

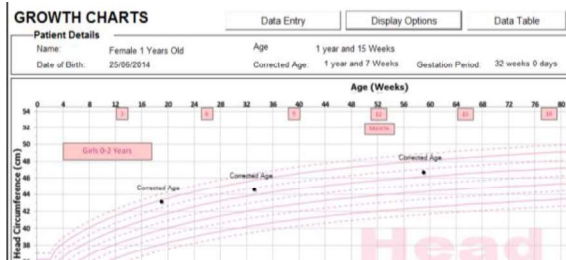
Display target Height  Yes  No

Selecting the radio buttons will display the appropriate change onto the chart.

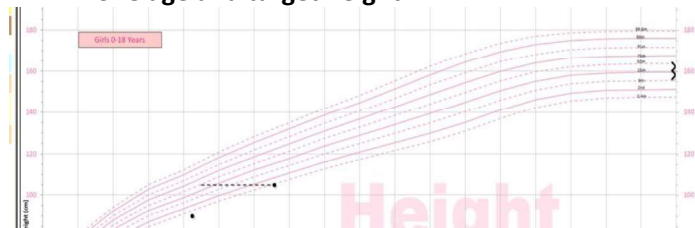
If premature gestation has been entered previously the recordings will be displayed with the gestation correction in the 0-2 chart.

Target height range is displayed as  symbol on the right Y axis of the 0-18 year chart.

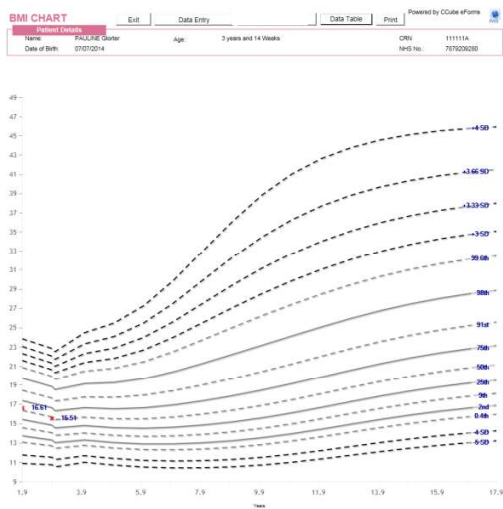
**Gestation correction**



**Bone age and target height**



**BMI chart**



This plots the calculated BMI on a chart that shows a background display of centiles and SD (Z) scores from +4 SD to – 5 SD. No data entry can be made from this screen

**Advanced data entry**

The advanced data entry is only available to Level 3 users and selected via Data Entry. This allows the user to:

- View all the recordings for a patient in a Data Table including bone age and the calculated values BMI and Height velocity
- Change recordings from provisional to confirmed status
- Delete any of the recording entries for a given date
- Modify any of the recordings for a given date
- Add bone age
- Add and modify parents height recordings
- Add and modify the patients gestation period
- Change to Down Syndrome chart display

**Recordings**

\*Retrospective data entry

Select	Age	HospNo	Recording Date	RecordingStatus	Height	Weight	Head Circ	BMI	Growth Velocity	Bone Age	Location	UserID
<input checked="" type="radio"/>	3 y and 40 d	6728526	14/11/2017	Confirmed	101	16.5	52.1	15.19	7.85	5	CL	T0042222
<input type="radio"/>	2 y and 0 d	6728526	02/02/2016	Confirmed	87	12.5	50.5	16.51	12.03		CL	T0042222
<input type="radio"/>	1 y and 26 d	6728526	04/08/2015	Confirmed	81	11.7	49	17.83	9.97			T0042222
<input type="radio"/>	1 y and 0 d	6728526	02/02/2015	Confirmed	76	10.2	47.5	17.66	16.04		CL	T0042222
<input type="radio"/>	26 d	6728526	04/08/2014	Confirmed	68	8.5	48.2	19.38			RV	T0042222

Gestation Period (weeks):       Down Syndrome:  Yes  No

Gestation Period (days):      

Mother's height (cm):

Father's height (cm):

To **delete** a recording, select the appropriate entry in the table and select the **DELETE** button. The entry is removed from the table.

To **modify** an existing recording, select the appropriate entry in the table and select the **MODIFY EXISTING ENTRY** button. A new screen will be displayed where the recordings can be changed. Select **SAVE** to apply your changes or **CANCEL** to not apply any changes. You will be returned to the above screen with any changes to the recordings reflected in the table.

**ADD BONE AGE** presents the same screen where the Bone age can be added to the relevant measurement recording.



Bone Age chart display needs to relate to a height measurement recording so ensure that the correct date has been selected.

To **add** or **modify parent height** values then enter the values into the boxes towards the bottom of the screen. Select **SAVE** to commit the changes.

To **add** or **modify gestation period** values then enter the values into the boxes towards the bottom of the screen. Select **SAVE** to commit the changes.

To change the background charts to **Down Syndrome** click on the button. This will change the entire range of charts for this patient, and will become the default display. It can be reversed.

As the number of entries in the table grows, entries not displayed on the screen can be accessed through the page links at the foot of the table.


Recordings

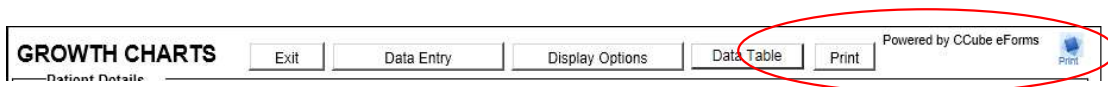
ADD      MODIFY      [ ]

Select	Recording Date	Height	Weight	Head Circ	BMI
<input checked="" type="radio"/>	Jan 1 2006	65	7		16.57
<input type="radio"/>	Jan 1 2007	80	15		23.44
<input type="radio"/>	Jan 1 2008	90	18		88.89
<input type="radio"/>	Jan 1 2009	99	20		20.41
<input type="radio"/>	Jan 1 2010	104	22		75.45
12					

Select the 2 to go to the second page of entries in the table.

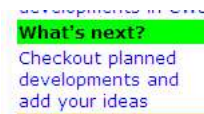
**Printing**

A full chart with the data table can be printed, or saved as a **pdf** by selecting a Print button at the top of the chart display screen. Selecting the  print option will only print a screenshot of whatever is currently displayed



### Continuing development

- The Growth Chart is now established across ABUHB, accessible and in use wherever there is CWS computer access.
- Paper charts only remain in use for selected patients – determined by the consultant
- The computer use is intuitive, and users should not encounter problems, but experienced staff in each area are available for assistance if required.
- Any problems encountered, and any suggestions for change / development are welcome, and should be sent via the Feedback link in CWS main menu.
- A design group will consider all comments and any problems hopefully solved quickly



### Proposed future developments

- Cosmetic improvements, including more speed
- User defined charts selecting both the range of any measurement (Y axis) and time range (X axis). This facility will enable use of the Growth Chart for adults.
- Charts for other syndromes / ethnic groups.
- An import facility to bring in measurements from any other electronic growth chart is being explored.
- A hyperlink facility ..... a mark on the chart which when clicked opens a related document in a pop-up window.
- An option to record Blood pressure at clinic attendance with an action alert for abnormality.
- Any other changes suggested by users and supported by the design group. Ideas welcome.



## **Appendix**

### **Growth chart centile display**

The background growth charts are derived from the “LMS Tables” under license from the Medical Research Council, and for Down Syndrome from the Down Syndrome Medical Interest Group.

The “LMS Tables” are those tables, developed by Professor Tim Cole, produced from  
(i) the UK90 data showing the value of L, M and S for the monthly weight, height, BMI, head circumference and other variables for populations of children of varying ages from birth to 20 years (standardised to year 1990), where M is the median figure, S is the coefficient of variation and L is a measure of skewness of the data relative to a normal distribution.  
(ii) by amalgamating WHO data from age 2 weeks with recalculated British 1990 birth data and as referenced in the publication: Wright CM, Williams AF, Elliman D, et al. Using the new UK-WHO Medical Apps. BMJ. 2010;340:c1140.

### **Gestation correction**

This is applied from 23 to 36 weeks. No correction is applied from 37 weeks.  
Selecting growth display on the 0-2 chart will shift any measurements back according to the gestation correction of (40-gestation). Gestation correction is not applied to the 0-4, and 0-18 charts.

### **Height velocity**

This is displayed as cm/year derived between any successive height measurements from the change in height, and the exact change in time between the dates of measurement

### **BMI calculation**

$BMI = \text{weight (kg)} / (\text{height(m)})^2$

Centile derived from the LMS tables

### **Z score**

$Z \text{ score} = (\text{sample value} - \text{sample mean}) / \text{standard deviation}$

Sample mean and standard deviation derived from the LMS tables

### **Target height range calculation**

Displayed on the chart at the 18th birthday as a range +/- 8.5cm above and below the target height calculated from:

Boys - Father's height + Mother's height/2 + 7cm

Girls - Father's height + Mother's height/2 - 7cm