

Cluster analysis of objective nebuliser adherence data among adults with CF: change in adherence over time and association with clinical outcomes

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BACKGROUND:

Adherence with preventative inhaled therapy is an important determinant of good health outcomes among people with CF but adherence is typically low with median adherence around 30-50%.^[1,2]

The Sheffield Adult CF centre has run pilot projects to improve nebuliser adherence since 2013 leading to a 2014 NIHR programme grant to develop a systematic adherence intervention. We have previously presented our 2013-2014 results,^[3] which showed a trend of increasing adherence magnitude. However, temporal variability of adherence and absolute magnitude can both influence health outcomes^[4] and there may be a threshold effect – a change in adherence from 5% to 35%, say, may impact outcomes differently to a change from 55% to 85%.

We have proposed a pragmatic algorithm based method taking into account both the variability and magnitude of adherence to identify four different adherence clusters.^[5]

AIMS:

1. To describe change in adherence clusters in Sheffield from 2013 to 2015.
2. To describe the association between adherence clusters with health outcomes.

METHODS:

This is a retrospective analysis of adherence data objectively measured with I-neb[®] nebulisers in the Sheffield Adult CF centre from 2013 to 2015. Adults on ivacaftor or with previous lung transplantation were excluded.

Adherence was calculated as ‘normative adherence’,^[6] then clustered according to the methods we described.^[5]

Change in % predicted FEV₁ for the different adherence clusters were compared using one-way analysis of variance (ANOVA). IV days for the different adherence clusters were compared using Kruskal-Wallis test.

REFERENCES:

1. Quittner AL, et al. Chest 2014;146:142-51
2. Daniels T, et al. Chest 2011;140:425-32.
3. Hoo ZH, et al. Pediatr Pulmonol 2016;51:S449.
4. Venkat VL, et al. Pediatr Transplant 2008;12:67-72.
5. Hoo ZH, et al. Patient Prefer Adherence 2017;11:631-42.
6. Hoo ZH, et al. Patient Prefer Adherence 2016;10:887-900.

RESULTS:

There was a consistent year-on-year increase in ‘Cluster 4’ (high adherence) and decrease in ‘Cluster 1’ (very low adherence).

Adults with ‘Cluster 4’ adherence have the lowest IV use. They also have the least subsequent annual % FEV₁ decline (although this did not reach statistical significance).

Change in adherence clusters from 2013 to 2015:

Adherence cluster, n (%)	2013 (n = 89)	2014 (n = 97)	2015 (n = 104)
Cluster 1 (very low adherence)	27 (30.3%)	22 (22.7%)	19 (18.3%)
Cluster 2 (low adherence)	40 (44.9%)	44 (45.4%)	54 (51.9%)
Cluster 3 (moderate adherence)	11 (12.4%)	15 (15.5%)	8 (7.7%)
Cluster 4 (high adherence)	11 (12.4%)	16 (16.5%)	23 (22.1%)

Annual IV days for the different adherence clusters:

Adherence cluster	IV days, median (IQR)		
	2013 (n = 89)	2014 (n = 97)	2015 (n = 104)
Cluster 1 (very low adherence)	22 (0 – 60)	25 (0 – 51)	15 (11 – 38)
Cluster 2 (low adherence)	28 (14 – 51)	14 (2 – 33)	27 (11 – 37)
Cluster 3 (moderate adherence)	12 (0 – 24)	14 (8 – 17)	26 (6 – 39)
Cluster 4 (high adherence)	0 (0 – 14)	7 (0 – 14)	9 (0 – 21)
Kruskal-Wallis p-value	0.001	0.051	0.035

% FEV₁ decline for the different adherence clusters:

Adherence cluster	% FEV ₁ change, mean (95% CI)	
	From 2013 to 2014 (n = 86)	From 2014 to 2015 (n = 96)
Cluster 1 (very low adherence)	-5.8 (-9.7 to -1.9)	-1.0 (-4.9 to 3.0)
Cluster 2 (low adherence)	-3.2 (-4.7 to -1.7)	-0.8 (-2.2 to 0.6)
Cluster 3 (moderate adherence)	0.2 (-1.5 to 1.9)	-2.5 (-4.9 to -0.1)
Cluster 4 (high adherence)	-1.1 (-5.6 to 3.4)	-0.5 (-4.6 to 3.6)
One-way ANOVA p-value	0.069	0.809

CONCLUSIONS:

There is a year-on-year increase in the proportion of adults with high nebuliser adherence in Sheffield between 2013 and 2015.

Adults with high nebuliser adherence have the best clinical outcomes.