P1-804

# Near-adult height in a large cohort of patients with Turner syndrome and Noonan syndrome treated with rhGH: Results from Pfizer International Growth Database (KIGS)

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Disclosure: MB Ranke and R Rooman have received consultancy fees from Pfizer. T Reinehr and R Rooman are members of the KIGS Steering Committee. A Lindberg and C Camacho-Hübner are full-time employees of Pfizer Inc., Endocrine Care. This study has been sponsored by Pfizer Inc.

## Background

KIGS contains data of Turner syndrome (TS; N=7378) or Noonan syndrome (NS; N=613, female=224; male=389) patients who were treated with rhGH. GH was not approved for the treatment of NS patients at the time of patient enrolment into KIGS®.

## Objective

To compare the effect of rhGH on near adult height (NAH) in TS and NS patients. We hypothesized a similar outcome in both diagnoses. Determinants of the treatment outcome were also assessed.

## Patients and Methods

Patients with TS (n=2766) or NS (F=66; M=74) who reached NAH were analyzed. NAH was assumed when HV was < 2 cm/yr and bone age > 14 yrs (f) or >16 yrs (m) (1). For analysing growth, references of Prader (1) and disease specific references (DSR) were used (2,3).

SAS® version 9 for Sun Solarix (SAS Institute, Cary, North Carolina) was used for all statistical analyses.

## Results

Clinical characteristics of the cohorts at GH start and at NAH are tabulated. In all groups, rhGH treatment was started during late childhood. At rhGH treatment start TS girls had an average height compared to TS references, but the NS patients had an average height in the lower half of the NS references. All groups received lower GH doses than those approved.

Height SDS gain in TS girls was 1.0 (±0.8) whereas NS (F) gained 1.3 (±0.7) and NS (M) 1.1 (±0.9) in height (Prader references). As in TS, the height gain in NS is mostly explained by: height at start first year growth and GH dose (positive) and age (negative).

| Table | | TS mean±SD | NS(F) mean±SD | NS(M) mean±SD |
|---|---|---|---|---|
| **At rhGH start** | Age (yrs) | 9.6±3.0 | 9.7±3.1 | 11.0±3.1 |
| | Height SDS* | -3.3±1.0 | -3.8±1.0# | -3.2±0.9## |
| | Height SDS** | 0.1±1.0 | -1.1±0.9# | -1.0±0.9 |
| | GH dose (mg/kg/wk) | 0.28±0.1 | 0.26±0.1 | 0.25±0.1 |
| **At NAH** | Age (yrs) | 16.9±1.6 | 16.7±1.8 | 18.4±1.6## |
| | Height SDS* | -2.3±1.1 | -2.5±1.2 | -2.1±1.2 |
| | Height SDS** | 1.6±1.1 | 0.1±1.1# | 0.5±1.2 |
| | Delta Ht SDS* | 1.0±0.8 | 1.3±0.7# | 1.1±0.9 |
| | GH dose (mg/kg/wk) | 0.29±0.1 | 0.30±0.1 | 0.27±0.1 |

***Prader reference; **DSR; #= p<0.01, NS (F) vs TS; ##= p<0.01; NS (F) vs NS (M)**

Based on KIGS data a prediction model for NAH [cm] after rhGH treatment in TS had been developed (4) which explains 67% of the variability with an error SD of 3.6 cm. When applying this equation to TS (n=817, met the inclusion criteria) a mean NAH of 151.7 cm (SD 5.0) was calculated while the mean actual height was 151.4 cm (SD 6.2). This equation was not applicable to patients with NS.

*Equation to predict NAH in TS (4): [NAH (cm) = 142.9 + (MPH [SDS] x 1.37) +(height at GH start [SDS] (TS) x 4.11) + (studentized residual 1st year x 1.99) + (mean GH dose [mg/kg/wk] x4.82) + (age at puberty start [yrs] x 0.74) – (age at GH start [yrs] x 0.33)].*

**Acknowledgments**: The authors express their thanks to all patients, parents and to all those KIGS investigators who provided data.

**References:**

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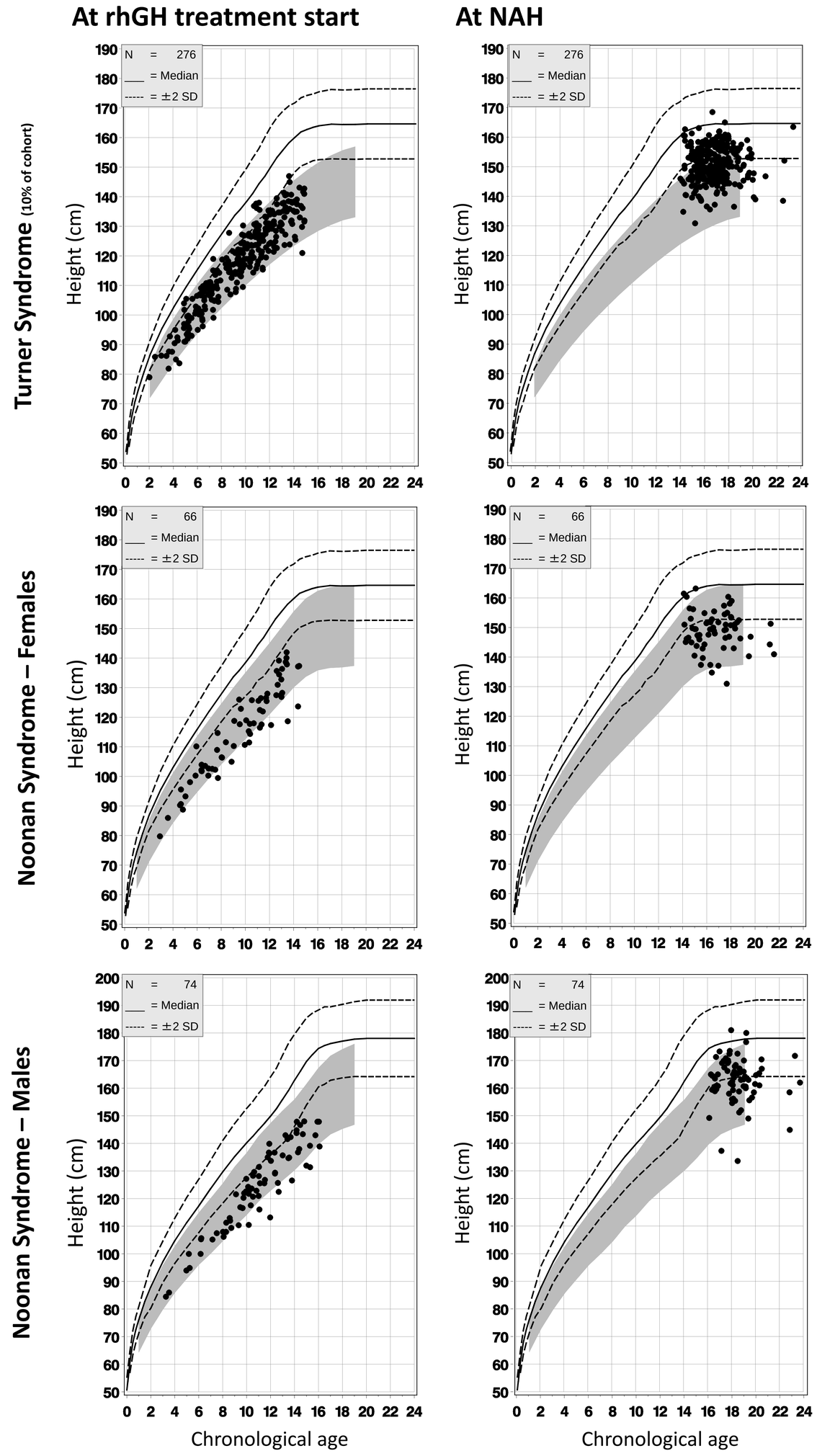
**Figures**: Height at rhGH treatment start and at NAH for TS and NS, for visibility a random selection of 10 % of the TS cohort are plotted below.




## Conclusions

- TS patients responded as expected (1.0 SDS gain) taking into account the late start of rhGH treatment and considering the suboptimal dose.
- NS patients responded slightly better which may be explained by their larger growth deficit at the start of treatment.
- Early start of rhGH and an individualisation of treatment are required for a more optimal outcome in these children.

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**55th Annual Meeting of the European Society of Paediatric Endocrinology, 10-12 September 2016, Paris, France**

55ESPE 804--P1

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DOI: 10.3252/pso.eu.55ESPE.2016

Poster presented at: ESPE 2016 PARIS

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