# Comparison of Ideal vs. Actual Weight Base Factor Dosing

## Background

Hemophilia is an x-linked (mainly affecting males) genetic disorder characterized by a mutation in the clotting factor VIII gene (hemophilia A) or the clotting factor IX gene (hemophilia B) resulting in spontaneous and trauma induced bleeding. This bleeding can be treated and prevented with clotting factor concentrate which has been available since the1960's. A randomized clinical trial published in 2007 [Manco-Johnson, NJEM 2007] established that prophylactic treatment with factor several times a week prevents bleeding and adverse clinical outcomes due to bleeding such as joint arthopathy. Thus, prophylactic treatment with clotting factor became standard of care in the U.s to prevent spontaneous bleeding.

Clotting factor replacement is given intravenously and is based on the patient's weight. The factor circulates in the plasma with a half-life of hours to days (depending on the product). It does not get distributed in the adipose (fat) tissue. Although plasma levels might increase with body mass index, it does not do this proportionally. The currently standard of calculating a patients dose on actual body weight, may therefore overestimate the needed dose and dosing calculations based on ideal body weight may be more accurate.

Factor concentrate is very pricy and can cost several thousand dollars per dose. Thus, inappropriate overdosing may not only be harmful for the patient but also leads to unnecessary health care cost.

Hypothesis: Factor dosing based on ideal body weight will result in hemostatic factor levels (recovery of at least 66% and a 6 hour half-life)

## Trial Design

This is a randomized, prospective, multicenter, open-label, cross-over study comparing the pharmacokinetics (PK) of ideal vs. actual body weight dosing of factor concentrate in patients with hemophilia.

The study will be conducted at the Washington Center for Bleeding Disorders (WCBD), Oregon Health & Science University (OHSU), Seattle Children's Hospital (SCH) and Sacred Heart Hospital (SH). Ethics approval will be obtained ~~at all~~at each individual location~~s~~ before trial enrollment begins for that location.~~.~~

Primary outcomes

1. To compare the recovery ~~response~~ to a ~~10~~50 units/kg dose of factor VIII (FVIII) concentrate in patients above age 11 with hemophilia A when calculated on *actual body weight (ABW)* versus *ideal body weight (IBW)*.

**Comment [LE1]:** Need to define recovery in the methodology.

2. To determine the likelihood of under dosing when using IBW or over-dosing with ACW

Secondary outcome

- to compare the recovery after ~~10~~50 units/kg dose of factor VIII (FVIII) concentrate in patients **less than 12 years** old with **hemophilia A** when calculated on *actual body weight* versus *ideal body weight*.
- ~~to compare the recovery after 100 unit/kg dose of factor IX (FIX) concentrate in patients **above age 11** with **hemophilia B** when calculated on *actual body weight* versus *ideal body weight*.~~
- ~~to compare the recovery after 100 unit/kg dose of factor IX (FIX) concentrate in patients **less than 12 years** old with **hemophilia B** when calculated on *actual body weight* versus *ideal body weight*.~~
- To determine the effect of these dosing strategies on half-life
- To determine the effect of hemophilia severity on PK differences
- To determine differences in patients taking normal half-life (NHL) vs. extended half-life (EHL) products
- To determine the difference in overweight (BMI 25-30) vs. obese (BMI >30)

Inclusion Criteria

- At least 2 years of age [primary endpoint will be patients 12 and over. Will likely not be able to have enough sample size to determine statistically significant differences in patients under 12 years of age, but may enroll these patients as a secondary endpoint]
- Hemophilia A ~~or B~~
- Male gender
- Able and willing to comply with PK testing schedule
- Either overweight body weight (BMI 25 - <30) or obese (BMI > or equal to 30)

Exclusion Criteria

- Inhibitor of > 0.6 BU twice in the past, or documented abnormal recovery of less than 66% in the past.
- Known other bleeding disorder
- Known other prolongation in aPTT (lupus anticoagulant, FXII deficiency)
- Female gender
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- ~~Acute bleeding 1 day prior of during PK study~~

Recruitment

Patients will be recruited through the participating centers.
Washington Center for Bleeding Disorders (WCBD), Oregon Health & Science University (OHSU), Seattle Children's Hospital (SCH) and Sacred Heart Hospital (SH).

**Comment [LE2]:** Need to be consistent on the age definition. (12 and over)

**Comment [LE3]:** Evaluate budget to determine if we have enough funds to include less than 12 years old.

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Study design - Primary outcome:

Patients age ~~12~~ and up with a BMI > 25 and hemophilia A of any severity will be enrolled.

There must be a period of at least 48 hours for standard half-life products and at least 72 hours for extended half-life products since the last dose of factor. Patients will be randomized to receive ~~10~~50 U/kg of the factor product they routinely use either based on IBW or ABW and will have pharmacokinetic (PK) labs drawn as described below. After a period of at least 48 hours for standard half-life products and at least 72 hours for extended half-life products~~2 weeks,~~ but no more than ~~2 months~~60 days, patient will receive a second dose of factor at 50 U/kg based on the alternate dosing strategy~~they will undergo~~ and will have a second PK test. drawn~~ing based on the alternate dosing strategy.~~

Pk studies will be delayed until the resolution of any acute bleeding episodes. If the patient has an acute bleed after the recovery draw that episode will not be used in the analysis. The episode will be attempted again at a later date within the 2-month window.

Intention to treat if a patient experiences a 10% or greater change in BMI between the first and second dose, the patient will be included in the analysis.

Minimum of 8 patients ages 12 and over


Minum of 8 patients ages 12 and over


~~Secondary outcome:~~
~~Hemophilia B~~
~~< 12 years~~

Ideal body weight calculation

Ideal body weight will be calculated as follows:

~~50 + 2.3 (height in inc. – 60)~~

Sites shall use CDC website (insert link) to calculate BMI for patients 20 years and older and determine if patients are overweight or obese.

Ideal body weight calculation in children, Mclearin method, Moore, BMI method

PK protocol:

**Comment [LE4]:** Remove factor IX

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**Comment [LE5]:** Need to include in methodology

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**Comment [LE6]:** Remove Hem B.

**Comment [LE7]:** Insert definition of BMI, NHLBI and CDC websites

**Comment [LE8]:** Members will reach out to nutritionists to get calculations for IBW and send to Ryan.

PK studies will be ~~measure~~ measured in response to one ~~100%~~ 50 U/kg (±20%) ~~corrective~~ dose of the patient's current product. Every effort shall be made to ensure the same size vials and same lot numbers to ensure the second dose is as close to the first dose as possible. ~~corrective dose of the patient's current product.~~
All patients will undergo PK testing twice: One with ~~a 100% corrective dose (~~50U/kg for hemophilia A ~~and 100U/kg for hemophilia B)~~ based on ideal body weight and once based on actual body weight.

Post dose blood draws cannot be pulled from the same port/IV as the factor was delivered.

*Hemophilia A – regular half-life product*

**Baseline** – Recovery drawn **30 min ± 5/10 minutes** ~~**to 60 min**~~, if the 30 minute draw is missed patient can still be included with another attempt of the dose/Pk draw) if the second dose/draw it must fall within the 2 month window. – **5 to 7 hours, – 20 to 26 hours, and – 44 to 50 hours**

*Hemophilia A – extended half-life factor*

**Baseline – 30 min to 60 min – 5 to 7 hours – 20 to 26 hours – 44 to 50 hours – 69 to 75 hours – 93 to 99 hours**

~~*Hemophilia B – regular half-life product*~~

~~**Baseline – 30 min to 60 min – 5 to 7 hours – 20 to 26 hours – 44 to 50 hours – 69 to 75 hours**~~

~~*Hemophilia B – extended half-life factor*~~

~~**Baseline – 30 min to 60 min – 5 to 7 hours – 20 to 26 hours – 44 to 50 hours – 69 to 75 hours – 93 to 99 hours – 117 to 123 hours**~~

[The pre-Pk and the recovery draws for the first and second doses ~~Yield~~ must be ~~done in~~ completed by the same lab. Blood draws to measure half-life may be drawn in other local labs. ~~Half-life is not feasible all in the same lab. BDC will develop criteria to determine if local labs are reasonable for inclusion in study.~~
~~BDC will develop criteria on when to accept historical fall-off (PK) from outside the study.]~~

Statistics

~~Acute bleeding 1 day prior of during PK study~~

The primary endpoint 1. Will be assessed by evaluation of the mean paired difference in recovery between the two methods (IBW vs. ABW dosing)

The primary endpoint 2. Will be evaluated by extension of estimated recovery distribution to estimate the likelihood of failure (under-dosing or over-dosing) of each dosing strategy.

- The "heterogeneity" between subgroups (e.g., effects only in the obese group with BMI>30)

**Comment [LE9]:** Mike to review clinical trials to see how they defined protocol for blood draws.

**Comment [LE10]:** Still need to determine a plus or minus 5 or 10 minute

**Comment [LE11]:** If the 30 minute draw is missed the attempt is scratched and then the patient would have another attempt.

**Comment [LE12]:** Need to include in methodology

- Establishing a “non-inferiority” margin indicating excess risk of dosing failure or excess loss of recovery using ideal body weight dosing compared to actual weight dosing

For the first of the above evaluation measures, assuming approximate normality of recoveries, we estimate having 80% power to detect a mean reduction of 1 standard deviation in a study of 16 subjects assuming an intra-class correlation of at least 0.2. Greater (lesser) intra-class correlation would increase (decrease) statistical power for this evaluation.

In the event that the study is underpowered (due to a lower than anticipated intra-class correlation), distributional summaries for each approach and for paired differences (including histograms) as well as for the intra-class correlation would be useful for design of future studies if the ideal weight base factor dosing is not deemed unacceptable according to thresholds for acceptability (to be determined prior to study initiation).

Power for paired comparisons of probabilities, and consideration of non-inferiority evaluation, require additional consideration and discussion.

Collecting and reporting out on Adverse events and serious adverse event.

**Comment [LE13]:** Get standard definitions of those two.