NFL MODEL OF QUARTERBACK RATINGS: A COMPOSITE METRIC

Since 1973 the National Football League has employed quarterback ratings to evaluate these athletes.

Touchdowns and interceptions relative to the number of passing attempts and yards per completion are used in the formula.

Most importantly, it highly correlates with a key outcome—wins!!!

WHO IS THE BEST QUARTERBACK OF ALL TIME?

Aaron Rodgers
Best QB rating of all-time career (106) & for a season (122.5)

The traditional outcome metric for determining the efficacy on an intervention is the change in A1C.

BUT…….A1C lacks information about:

- time-in-range
- frequency/duration/severity of hyperglycemia
- frequency/duration/severity of hypoglycemia
- glycemic variability

Several new classes of medications and better technologies have emerged which:

- ↓ A1C with no effect on hypoglycemia
- ↓ hypoglycemia with no effect on A1C

Composite metrics:

- Change the conversation from A1C alone to one that is more glucose-centric (i.e., glucose is a vital sign)
- May help HCPs, regulators, and payers better understand what is best for patients by allowing a comparison of efficacy across the different types of interventions.

VISUAL REPRESENTATIONS OF COMPOSITE OUTCOMES

NUMERIC REPRESENTATIONS OF COMPOSITE OUTCOMES

VISUAL and NUMERIC REPRESENTATIONS OF COMPOSITE OUTCOMES
Continuous Glucose Monitoring: Evidence and Consensus Statement for Clinical Use

Andrea Laht, MD, PhD; Howard B. Fischer, MD; Leslie Hannahs, MD, PhD
Keith Winstein, MD; Donald B. Barnes, MD; and Andrew Thomas, PhD
for the Continuous Glucose Monitoring Working Group of the
American Diabetes Association

Outpatient Glycemic Control with a Bionic Pancreas in Type 1 Diabetes

Stanley, Ronald M, L.D., Ph.D., James R. McInnes, Ph.D., Mary I. Siroka, M.D., MD., Ph.D.,
Laura L. Carney, D.N., R.N., Taylor Skolnick, D.D.S., R.N.,
Marilyn A. Haddad, E.S., David M. Nathan, M.D., and Stanley E. Daneman, M.D.

Evaluating Quality of Glycemic Control: Graphical Displays of Hypo- and Hyperglycemia, Time in Target Range, and Mean Glucose

David Redmond, MD

Central Tendency

Intra-day Variability

Hypoglycemia

Hyperglycemia

Inter-day Variability
Efficacy and safety of canagliflozin versus glimepiride in patients with type 2 diabetes inadequately controlled with metformin (CANTATA-SU): 52 week results from a randomised, double-blind, phase 3 noninferiority trial

For the CANTATA-SU Trial Investigators


Lancet 382:941-950, 2013

Threshold-Based Insulin-Pump Interruption for Reduction of Hypoglycemia

For the ARBIRD in Home Study Group

Richard W. Bergenstal, M.D., David C. Chopra, M.D., Susan K. Carg, M.D., Bruce W. Bode, M.D., Delphine Bernard, M.D., Robert W. Shulman, M.D., Andrew W. Ahern, M.D., John D. Wolfs, M.D., Ph.D., Scott W. Lee, M.D., and Francisco B. Astrup, M.D.

A Psychoeducational Program to Restore Hypoglycemia Awareness: The DAFNE-HART Pilot Study

<table>
<thead>
<tr>
<th></th>
<th>GRP (Area in a person with diabetes)</th>
<th>Area in a person without diabetes</th>
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</thead>
<tbody>
<tr>
<td>Acu better by ≤2%</td>
<td>94</td>
<td>50</td>
</tr>
<tr>
<td>Acu better E(5-15)%</td>
<td>88</td>
<td>60</td>
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<tr>
<td>Acu better E(15-20)%</td>
<td>79</td>
<td>75</td>
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<tr>
<td>Acu better E(20-25)%</td>
<td>78</td>
<td>85</td>
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<tr>
<td>Acu better E(25-30)%</td>
<td>77</td>
<td>95</td>
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<tr>
<td>Acu better E(30-35)%</td>
<td>76</td>
<td>100</td>
</tr>
</tbody>
</table>

De Zoysa N et al. Diab Care 37:863-866, 2014
New Way of Displaying Hypoglycemia

ASPIRE In-Home Study
Example for big differences in "intensity of hypoglycemia" and hypoglycemia "volume"


ASPIRE In-Home Study
Example for middle differences in "intensity of hypoglycemia" and hypoglycemia "volume"


ASPIRE In-Home Study
Example for same hypoglycemia rate, but big differences in "intensity of hypoglycemia" and hypoglycemia "volume"

CONCLUSION

Now
- "mental modeling"

Future
- Multicomponent single value that will provide:
  - A glucose-centric, simple, and more comprehensive understanding of an intervention’s effect
  - Be capable of incorporating non-traditional metrics like patient reported outcomes (PROs)
  - A way that new interventions can be assessed, approved by regulatory agencies, and paid for not only on the basis of a change in A1C

Example visual and numeric representations of composite outcomes:

3-month frequency of severe hypoglycemia* according to HbA1c

Visual and numeric representations of composite outcomes:

- Hypoglycemia intensity
- Hyperglycemia intensity

Visual representations of composite outcomes:

NUMERIC REPRESENTATIONS OF COMPOSITE OUTCOMES

VISUAL and NUMERIC REPRESENTATIONS OF COMPOSITE OUTCOMES
HbA1c and Risk of Severe Hypoglycemia in Type 2 Diabetes

The Diabetes and Aging Study

10.8% overall

ECONOMIC BURDEN OF HYPOGLYCEMIA – EFFECT OF THE ACA

Direct cost of diabetes in the U.S. is $179 million in 2012

2010
$14.7 billion

2020
$24.5 billion