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REVIEW ARTICLE

The Blue Index – A Comprehensive Diabetes Assessment Score

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CHALLENGES APLENTY

Targets are necessary in order to achieve targets. One of the most challenging aspects of target-based medicine, however, is defining easily measurable goals. This is especially true in diabetology, where multiple metabolic end points must be met in order to achieve comprehensive medical care.

The vast number of pathophysiologic mechanisms, monitoring investigations, pharmaceutical tools, and non-pharmacological interventions create a challenge for the overburdened diabetologist. Faced with the multiplicity of clinical activities, it is all too easy to inadvertently omit important aspects of diabetes management. It is even tougher to explain the various thought processes of diabetes care to persons with diabetes, in a manner which is easy to understand.

THE BLUE INDEX

We hereby propose a comprehensive index which can be used to periodically evaluate and monitor the quality of diabetes care. The Blue Index is a composite representation of the Diabetes Health Score (DHS) against the 'Komplications Score' (KS), presented as a whole numerical ratio (not to be divided) i.e., Blue Index = Diabetic Health Score / Komplications Score

Diabetes Health Score

The DHS is an expansive summation of 10 essential parameters of comprehensive diabetes care, spanning three domains—three metabolic goals (HbA1c, blood pressure, lipids), three non-metabolic health parameters (general health, infection, jeopardy related to diabetes treatment), and four self-care parameters (diet, exercise, follow up, dependence on tobacco or alcohol). Each parameter is graded on a 6 point (zero though 5) scale, with a higher score denoting better performance (Table 1). The grading for these goals is based upon recommendations from professional international bodies, including American Diabetes Association (ADA) and American Association of Clinical Endocrinologists (AACE)/American College of Endocrinology (ACE)[1,2] and landmark trials.[3] Adherence to diet, physical activity, exercise,

and follow up is based upon a pragmatic assessment of the person's efforts to follow suggested advice.[4,5] The person's willingness to abstain from tobacco, exercising basic precautions to prevent infection, as well as current vaccination status are also included in the scoring system. The minimum possible score, therefore, is 0, and the maximum, 50.

Komplications Score

The KS explores the presence and severity of all current diabetes-related cardiovascular/macrovascular (C), microvascular (M), and foot (F) complications, as well as the efforts taken to optimally treat the same.[6–8] It also emphasizes the proactive approach of periodic screening for potential complications wherever recommended. Each of these three arms are scored from 0 to 5, each implying a minimum possible score of 0 and maximum of 15 (Table 2). Here, however, the desirable score is the least possible score in each category, implying that a score of '0' denotes absence of any complication, and higher scores indicate greater number or greater severity of complications. It is represented as:

Komplications Score = ___ (C_M_F_)

This format of representing the Komplications Score provides an instant insight into the presence and degree of complications, as well as the category of complications which is predominant and calls of immediate focused intervention at the given point of time.

The Blue Index, hence, is a composite assessment of both, the diabetes-related health parameters as

Table 1 | Diabetes Health Score

SCORE	5	4	3	2	1	0	YOUR SCORE
Average Blood Sugar-HbA1C	At or Below Target	0.1-0.5% More Than Target	0.6-1% more Than Target	1.1-2% more Than Target	2.1-4% more Than Target	>4% Above Target	
Blood Presure-SBP DBP	At Target Without Medicine	At Target With Medicine	0-10 mmHg Above Target or 0-5 mmHg Above Target	10-20 mmHg Above Target or 5-10 mmHg Above Target	20-40 mmHg Above Target or 10-15 mmHg Above Target	>40 mmHg Above Target or >15 mmHg Above Target	
Cholesterol-TG, LDL, Non HDL	All 3 At Target Without Medicine	All 3 At Target With Medicine	One of the 3 Above Target	Two of The 3 Above Target	All 3 Above Target	TG >500 or LDL > 190 or Non HDL > 220	
Det-Calorie/ Composition/ Pattern	Fully Compliant	Mostly Compliant	Partially Compliant	Mostly Non-Compliant	Totally Non Compliant	Non complaint & Not willing to change	
Exercise-Aerobic/ Yoga, Meditation, Resistance, Work-related physical activity	Fully Compliant	Mostly Compliant	Partially Compliant	Mostly Non-Compliant	Totally Non-Compliant	Non compliant & Not willing to change	
Follow-up-Clinical, Lab, SMBG	Fully Compliant	Mostly Compliant	Partially Compliant	Mostly Non Compliant	Totally Non Compliant	Not willing or not able to follow-up	
General Health	OBESITY, RESPIRATORY DISEASE/OSA, MENTAL STRESS/DISEASE, MALIGNANCY, LIVER DYSFUNCTION/NAFLD, BONE/JOINT PROBLEMS, THYROID DISORDER, ANEMIA						
	0/8	1/8	2/8	3/8	4/8	>5/8 OR 1 active or advanced disease condition	
Habits	No Habits, Neither in past Nor current	Ex Smoker or Tobacco	Light Smoker (<10/d) or Light Tobacco	Moderate Smoker (10-20/d)	Heavy smoker (>20/d) &/or Heavy Tobacco	Moderate/Heavy Smoker/ Tobacco Chewer OR Ethanol	

Table 2 | The Blue Index score sheet (A–J) and Komplications score

DIABETIC HEALTH SCORE						
NAME:	**AGE:**		**ID:**		**DURn:**	
SCORE	**DAY 1**	**DAY 90**	**DAY 20**	**day 50**	**DAY 80**	**DAY 10**
A-A1C						
B- BLOOD PRESSURE						
C-CHOLESTEROL						
D-DIET						
E-EXERCISE						
F-FOLLOWUP						
G-GENERALHEALTH						
H-HABITS						
I-INFECTION						
J-JEOPARDYTREATMENT						
SCORE-OUTOF 50	0	0	0			
TARGET:						

K-COMPLICATIONS SCORE

MACROVASCULAR

CAD or HF with NYHA -4/ Stroke with significant N.deficit** = 5
CAD-not optimally treated or HF with (NHYA 2-3)/ Stroke with minimal deficit # = 4
Established CVD/CAD and Optimally treated (Angina/MI/ACS/TIA/Stroke without N.deficit) = 3
Suspected CVD/CAD (suggestive Signs / Symptoms) = 2
No clinical evidence of CVD/CAD: No abnormal signs / symptoms, but not optimally evaluated = 1
Optimally evaluated for CVD/CAD and normal * = 0

MICROVASCULAR						
EGFR						
UACR			NA			
RETINA	FINDINGS		NA			
KIDNEY						
e-GFR	>60	>90	60-89	30-59	<30	<15/RRT
UACRmg/GCr	<30	>30	>30	>30	>300 (A3)	>300 (A3)
EYES	No DR	No DR	Mild-Mod NPDR	Severe NPDR	PDR	CSME

FOOT/Neuropathy			
STRUCTURAL		FUNCTIONAL	
PARAMETER	SCORE	PARAMETER	SCORE
Edema / cracks / fissures	1	s/o Neuropathy:- Positive symptoms	1
Abnormal pressure sites	1	Signs / Symptom s/o Neuropathy:- LOPS	2
Corns / Callosities	2	S/o Vascular Claudication	2
(Past and healed) infection / ulceration-distal / superficial	2	Absent / weak peripheral pluses	3
Active infection / ulceration-distal / superficial	3	Abnormal ABI<0.9	3
Deformities-Claw toes / Hammer toes / Halux / Flat foot	3	Abnormal ABI<0.7	4
Midfoot widening	3	Insensate Foot	4
(Past and healed) infection / ulceration-proximal / deep extension	3	Imaging Diagnostic PVD-optimally treated	4
Established Charcot's Foot	4	Imaging Diagnostic of PVD-NOT optimally treated	5
Active infection / ulceration-proximal / deep extension	4	H/o Amputation / Surgery / Non healing ulcer	5
H/o Amputation / Surgery / Non healing ulcer	5	Autonomic Neuropathy	FA
*as per clinicians discretion- ideally functional (stress testing) and strucural (2 D Echo) # not requiring assistance for daily activities			
Blue Index = D.H.S / K.S. = _____ /_____ C__M__F__			

well as the systemic complications arising due to or in relation to diabetes. The choice of blue is inspired by the color of the International Diabetes Federation logo, Unite for Diabetes.

COMPREHENSIVE PICTURE

The Blue Index represents the quality of diabetes care being achieved at a particular time in the individual's journey with diabetes. It is a truly patient-centered index, as it provides equal weight age to patient-driven efforts, i.e., diet, physical activity, follow up, habits, etc., as well as physician-lead interventions, i.e., HbA1c, blood pressure, lipids, etc. Therefore, it shifts the perspective of diabetes management from a gluco-centric to a multi-dimensional approach, encompassing both pharmacological as well as non-pharmacological (lifestyle and behaviour modification) aspects of treatment, including various vascular and metabolic parameters. Nevertheless, it continues to acknowledge the importance of stable glycemia by listing both hyperglycemia (HbA1c) and hypoglycemia (jeopardy of treatment) as equi-weighted points (Table 1).

In true sense, the Blue Index is concordant with the bio-psychosocial model of health, as well as the World Health Organization definition of health,[9] by encouraging not merely absence of complications, but also non-metabolic aspects of health such as infection prevention (vaccination), abstinence from tobacco, regular yoga and meditation for mental and social well-being. This approach encourages proactive behavior on part of both, the diabetes care provider as well as the care seeker, and reflects ancient Indian wisdom as written in the *Bhagavad Gita* (in order to attain the ultimate "goodness," one must be proactive and seek to be illuminated with knowledge from all directions).[10]

Pragmatic Use

The Blue Index can be used as a tool to evaluate and monitor quality of diabetes care at each clinical visit. The index can be administered by a physician or a paramedical diabetes care provider. Low scores imply poor effort and/or poor outcomes, and suggest the need for more intensive intervention, particularly focusing on the parameters where lower scores have been noted. Thus, the index can serve as a triage tool to help determine the urgency and intensity of diabetes care interventions, and also channelize them toward areas needing maximum attention.

As the Blue Index is intended to be evaluated periodically on serial follow-ups, the score can also be plotted on a graphs, with score on the "y" axis, and time/date on the "x" axis. This provides a bird's eye view of current and previous status of diabetes care as well as complications. Sudden changes in the total scores should prompt a detailed evaluation of medical care, lifestyle factors, and complications. The index also works as a motivational tool for persons with diabetes, providing positive reinforcement to those with high scores, and identifying areas requiring greater input to those with lower scores, thereby encouraging them to do better.

The authors have used the Blue Index in their clinical practice for over a year now,[11] and find it a useful aid in patient education and clinical decision making. We hope that this publication will spur interest in this concept, and help improve the quality of such a quantitative assessment index of comprehensive diabetes care.

SUMMARY

The Blue Index provides a comprehensive, pragmatic, patient-centered and team-based means of assessing care in persons with diabetes. It serves as a tool for education, as a monitoring index and as an aid to clinical decision making. As a teaching tool, it can be used to explain the importance of diabetes self-care and lifestyle modification to persons with diabetes and their families. As a monitoring index, it provides a comprehensive overview of quality of care. It may be used to compare inter individual and intra-individual trends in health status. The main role is in clinical triage, helping identify high risk persons who need intensive clinical intervention. It also helps pin point specific areas for improvement, and provides a framework for evaluation of the efficacy of interventions (Table 3).

Table 3 | The Blue Index - Summary

STRENGTHS

- Comprehensive coverage of
  - Glucose control
  - Vasculo-metabolic health
  - Mental health
- Equal weightage to efforts and targets
- Respectful of
  - WHO definition of health
  - Bio psychosocial model of health
  - Patient centered approach

UTILITY

- To assess current diabetes care
- To assess trends in diabetes care
- To identify persons who need intensive intervention
- To identify specific areas of health which need intensive intervention
- To serve as positive motivational tool
- To serve as teaching tool

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