La gestione delle frecce di tendenza

Andrea Laurenzi

I.R.C.C.S. Ospedale San Raffaele

quali informazioni fornisce il CGM?

Valore glicemico

Target glicemico / Livelli degli allarmi

Freccia di tendenza

Grafico ore precedenti

cosa indicano le frecce

- Premessa 1: la cinetica d'azione dell'insulina nel sottocute è caratterizzata da una certa latenza di effetto sulla glicemia

- Premessa 2: l'effetto della perturbazione sulla glicemia degli ultimi 15-20 min verosimilmente si protrae nei minuti successivi

cosa indicano le frecce

System					
⇈	NA	NA	>3 mg/dl 0.2 mmol/l per minute	NA	NA
↑↑	NA	>3 mg/dl >0.2 mmol/l per minute	2-3 mg/dl 0.1-0.2 mmol/l per minute	2-3 mg/dl >0.1 mmol/l per minute	NA
↑	>2 mg/dl >0.1 mmol/l per minute	2-3 mg/dl 0.1-0.2 mmol/l per minute	1-2 mg/dl 0.05-0.1 mmol/l per minute	1-2 mg/dl 0.05-0.1 mmol/l per minute	>2 mg/dl >0.1 mmol/l per minute
↗	1-2 mg/dl 0.05-0.1 mmol/l per minute	1-2 mg/dl 0.05-0.1 mmol/l per minute	NA	NA	1-2 mg/dl 0.05-0.1 mmol/l per minute
→	<1 mg/dl <0.05 mmol/l per minute	<1 mg/dl <0.05 mmol/l per minute	NA	NA	0-1 mg/dl 0-0.05 mmol/l per minute
↘	1-2 mg/dl 0.05-0.1 mmol/l per minute	1-2 mg/dl 0.05-0.1 mmol/l per minute	NA	NA	1-2 mg/dl 0.05-0.1 mmol/l per minute
↓	>2 mg/dl >0.1 mmol/l per minute	2-3 mg/dl 0.1-0.2 mmol/l per minute	1-2 mg/dl 0.05-0.1 mmol/l per minute	1-2 mg/dl 0.05-0.1 mmol/l per minute	>2 mg/dl >0.1 mmol/l per minute
↓↓	NA	>3 mg/dl >0.2 mmol/l per minute	2-3 mg/dl 0.1-0.2 mmol/l per minute	>2 mg/dl >0.1 mmol/l per minute	NA
⇊	NA	NA	>3 mg/dl >0.2 mmol/l per minute	NA	NA

Ziegler R et Al: *J Diab Sci Tech* 2019

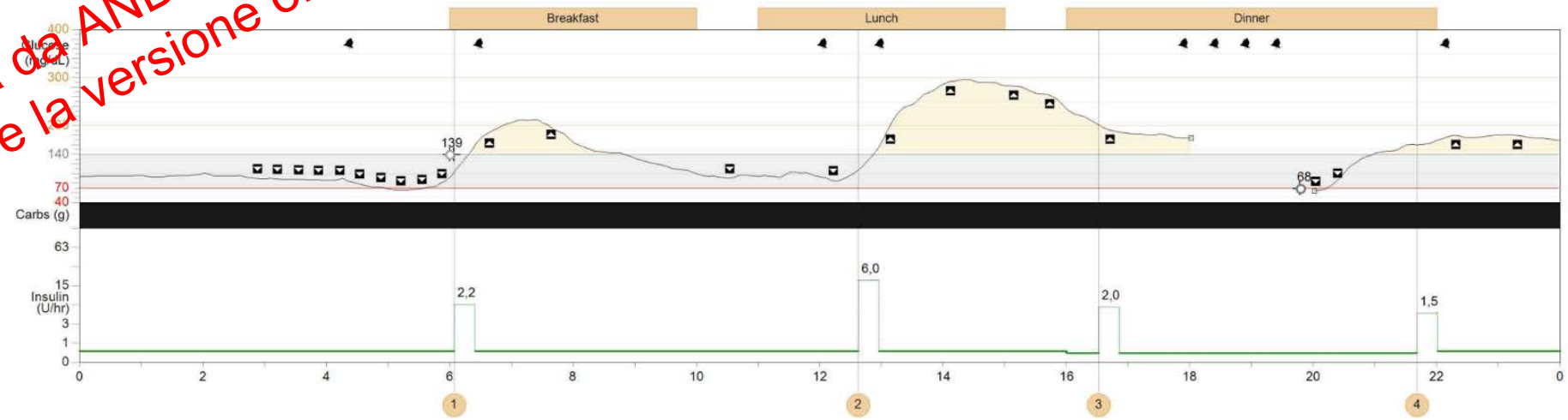
variabili da considerare

- Target glicemico
- Cinetica di azione dell'insulina (insorgenza, durata e picco d'azione)
- Impatto del pasto e dei nutrienti sulla glicemia (indice glicemico, carico glicemico, contenuto di grassi e proteine, …)
- Attività fisica e tipologia di esercizio (aerobico, anaerobico, misto)
- Farmaci (corticosteroidi)
- Situazioni particolari (stress, malattia, fase del ciclo mestruale, …)

Pettus J, Eldeman SV: *J Diab Sci Tech* 2017

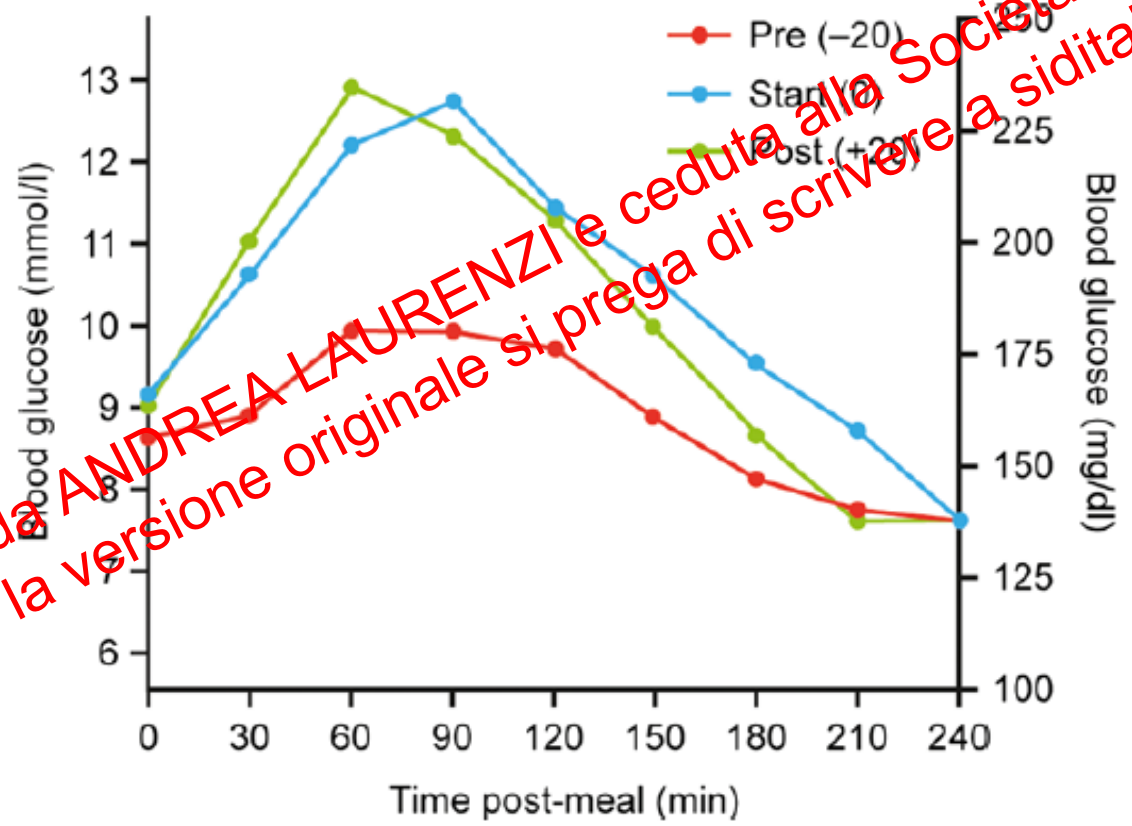
variabili da considerare

cinetica di azione dell'insulina



variabili da considerare

cinetica di azione dell'insulina



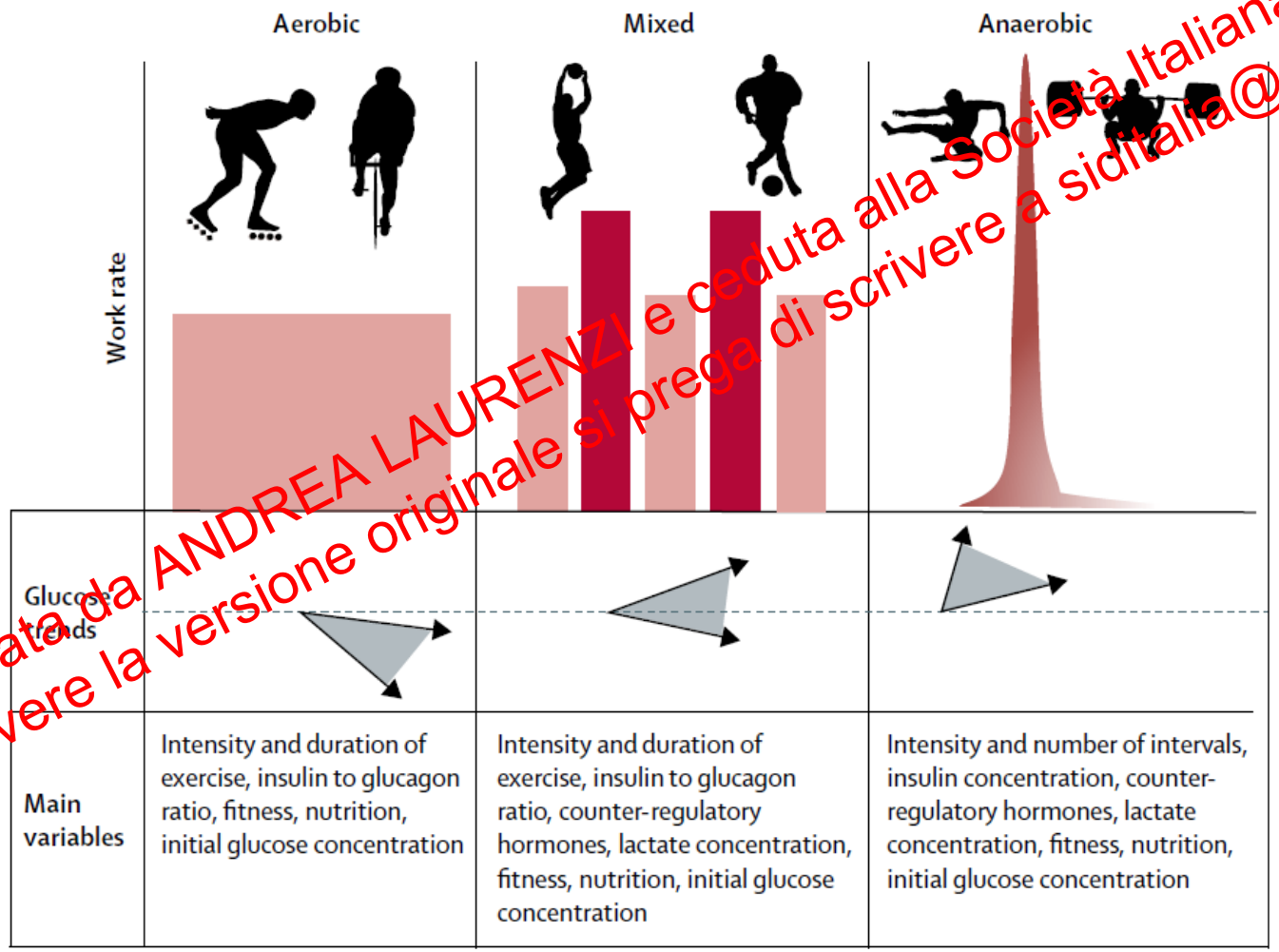
Slattery, Amiel, Choudhary, *Diabetic Medicine* 2017

variabili da considerare

cinetica di azione dell'insulina

variabili da considerare

attività fisica e tipologia di esercizio



Riddell MC et al, *Lancet Diab Endocr* 2017

le prime indicazioni: DirectNet/JDRF

Use of the DirecNet Applied Treatment Algorithm (DATA) for diabetes management with a real-time continuous glucose monitor

Diabetes Research In Children Network (DirecNet) Study Group*

	ROC	Aggiustamento del bolo insulinico
↑	>2 mg/dL/min	+20%
↗	1-2 mg/dL/min	+10%
→	<1 mg/dL/min	Nessuna modifica
↘	1-2 mg/dL/min	-10%
↓	>2 mg/dL/min	-20%

DirectNet Study Group: *Pediatric Diabetes* 2008

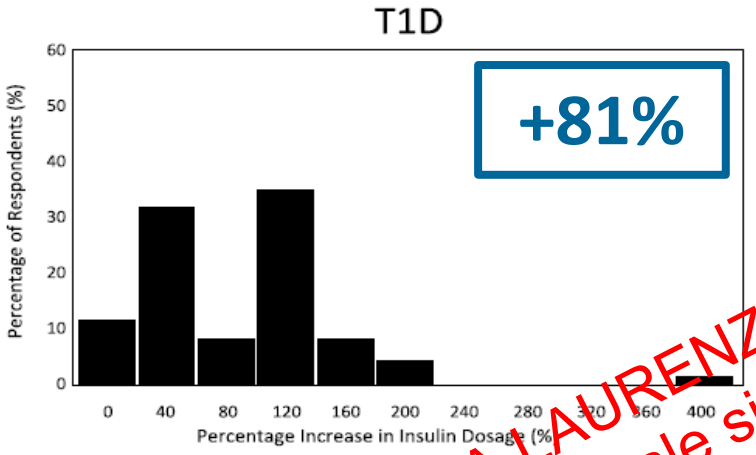
indicazioni basate sul previsione della glicemia

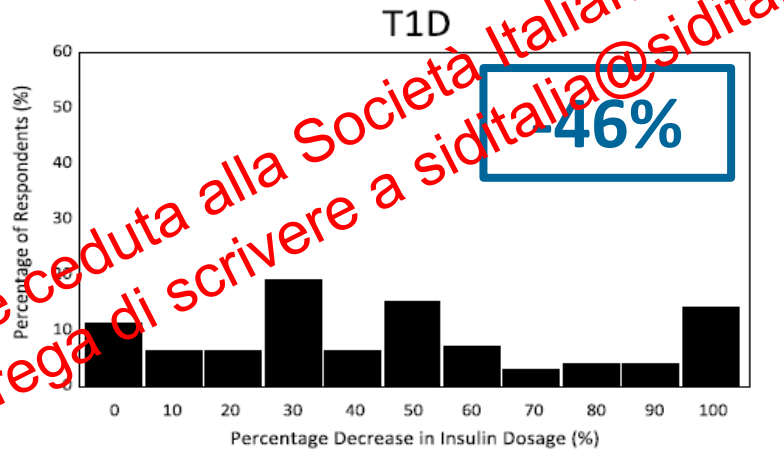
	ROC	Aggiustamento del bolo insulinico
⇈	>3 mg/dL/min	**Glicemia attuale + 50 mg/dL**
↑	2-3 mg/dL/min	**Glicemia attuale + 25 mg/dL**
↗	1-2 mg/dL/min	**Nessuna modifica**
→	<1 mg/dL/min	**Nessuna modifica**
↘	1-2 mg/dL/min	**Nessuna modifica**
↓	>2 mg/dL/min	**Glicemia attuale - 25 mg/dL**
⇊	>3 mg/dL/min	**Glicemia attuale - 50 mg/dL**

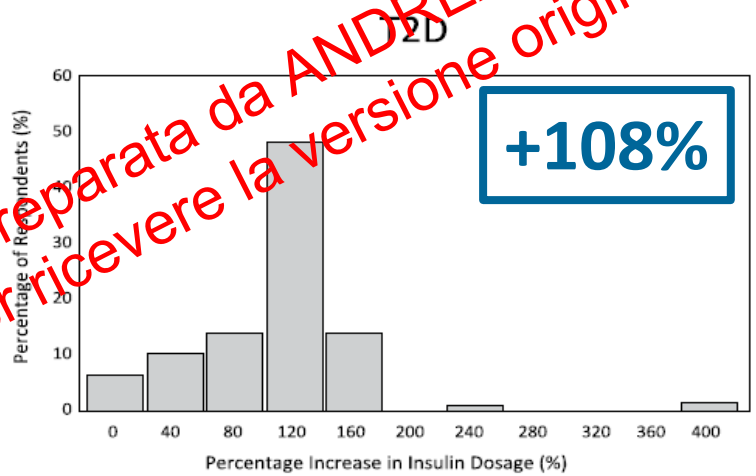
Scheiner G: *Practical CGM.* A Guide to Improving Outcomes through Continous Glucose Monitoring 2015

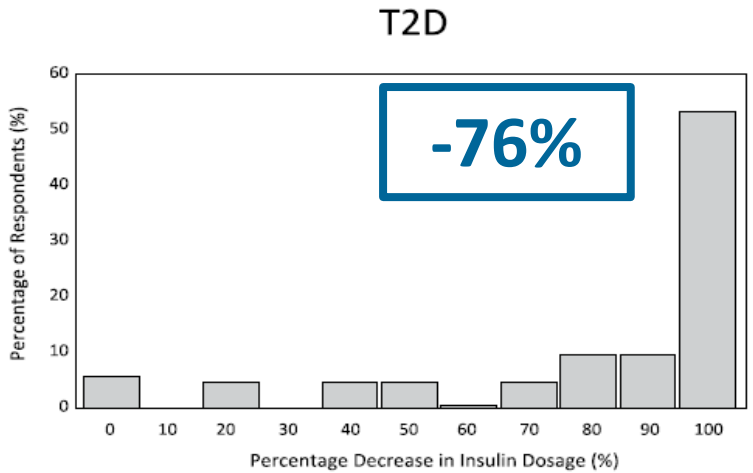
come i pazienti utilizzano le frecce

110 ↑↑ **PRE-PASTO** **110 ↓↓**









Pettus J, Eldeman SV: *J Diab Sci Tech* 2016

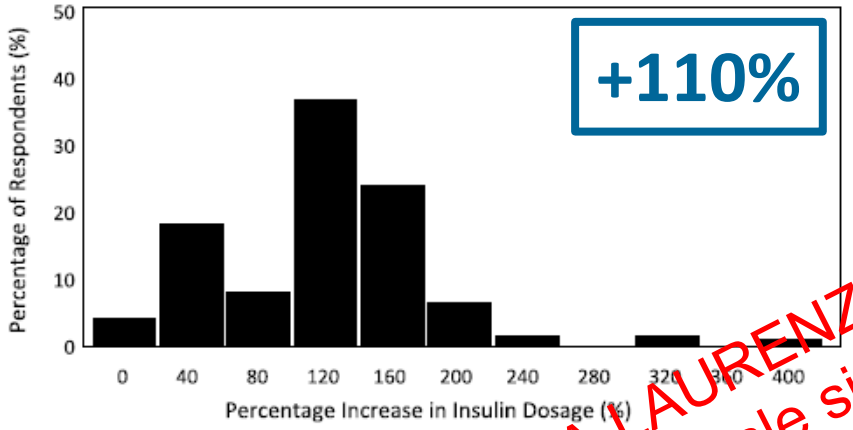
come i pazienti utilizzano le frecce

220 ↑

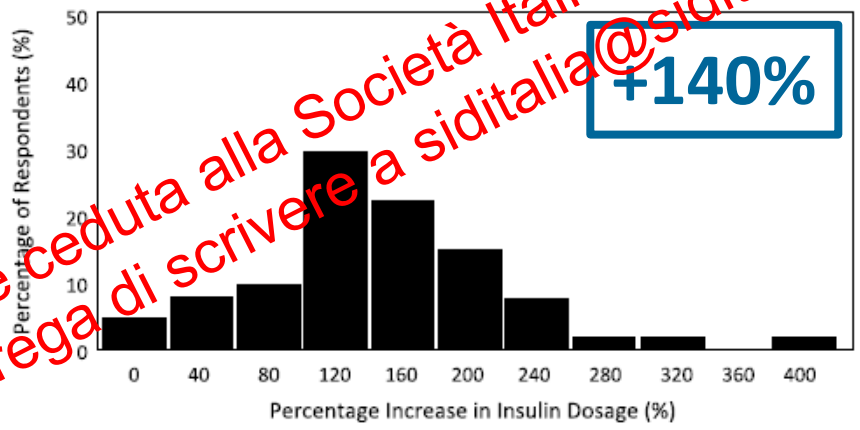
BOLO CORRETTIVO

220 ↑↑

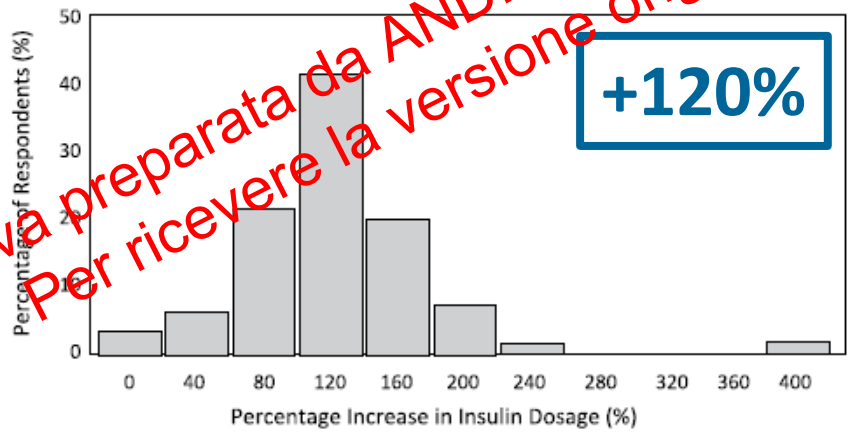
T1D



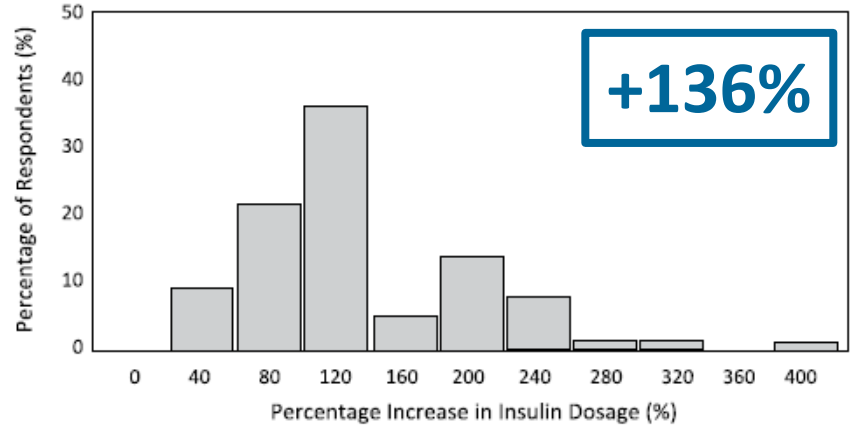
T1D



T2D



T2D



Pettus J, Eldeman SV: *J Diab Sci Tech* 2016

nuove indicazioni basate su previsione

Recommendations for Using Real-Time Continuous Glucose Monitoring (rtCGM) Data for Insulin Adjustments in Type 1 Diabetes

Jeremy Pettus, MD[1] and Steven V. Edelman, MD[1]

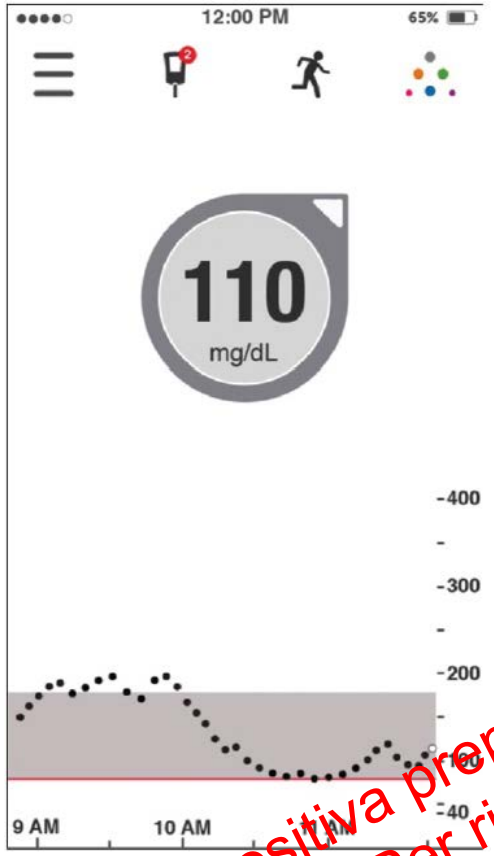
Adjusted Glucose Value for Dosing	
Glucose is not increasing/decreasing >1 mg/dl (0.06 mmol/l) per min	No Adjustment. Dose for current glucose value.
Glucose increasing 1-2 mg/dl (0.06-0.11 mmol/l) per minute	Adjust UP -- current value plus **50 mg/dl** *Actual Range: 30-60 mg/dl*
Glucose increasing 2-3 mg/dl (0.11-0.17 mmol/l) per minute	Adjust UP -- current value plus **75 mg/dl** *Actual Range: 60-90 mg/dl*
Glucose increasing >3 mg/dl (0.17 mmol/l) per minute	Adjust UP -- current value plus **100 mg/dl** *Actual Range: 90-150 mg/dl*
Glucose decreasing 1-2 mg/dl (0.06-0.11 mmol/l) per minute	Adjust DOWN -- current value minus **50 mg/dl** *Actual Range: 30-60 mg/dl*
Glucose decreasing 2-3 mg/dl (0.11-0.17 mmol/l) per minute	Adjust DOWN -- current value minus **75 mg/dl** *Actual Range: 60-90 mg/dl*
Glucose decreasing >3 mg/dl (0.17 mmol/l) per minute	Adjust DOWN -- current value minus **100 mg/dl** *Actual Range: 90-150 mg/dl*

The most conservative response to down arrows is to delay insulin administration until the trend arrow turns horizontal.

Calcolare la dose preprandiale in base alla glicemia prevista dopo 30-60 minuti

Pettus J, Eldeman SV: *J Diab Sci Tech* 2017

nuove indicazioni basate su previsione



➔ Dopo 30 min avremo glicemia tra 140 e 170 mg/dL (=160 mg/dL secondo Pettus/Eldeman)

SE: target = 110 mg/dL
FSI = 50 mg/dL/U
CHO:I = 15 g/U
pasto con 45 g di CHO

➔ 3.0U + 1.0 U = **4.0U**

Adjusted Glucose Value for Dosing

Glucose is not increasing/decreasing >1 mg/dl (0.06 mmol/l) per min	No Adjustment. Dose for current glucose value.
Glucose increasing 1-2 mg/dl (0.06-0.11 mmol/l) per minute	Adjust UP -- current value plus **50 mg/dl** *Actual Range: 30-60 mg/dl*
Glucose increasing 2-3 mg/dl (0.11-0.17 mmol/l) per minute	Adjust UP -- current value plus **75 mg/dl** *Actual Range: 60-90 mg/dl*
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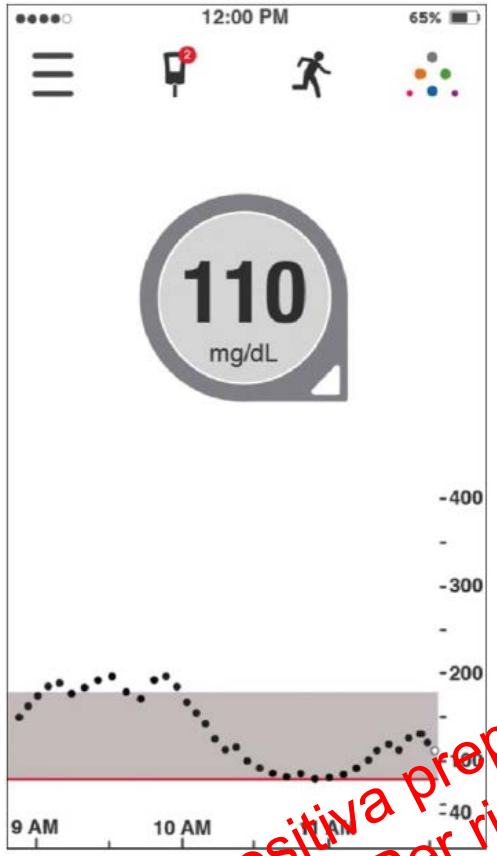
Glucose decreasing 1-2 mg/dl (0.06-0.11 mmol/l) per minute	Adjust DOWN -- current value minus **50 mg/dl** *Actual Range: 30-60 mg/dl*
Glucose decreasing 2-3 mg/dl (0.11-0.17 mmol/l) per minute	Adjust DOWN -- current value minus **75 mg/dl** *Actual Range: 60-90 mg/dl*
Glucose decreasing >3 mg/dl (0.17 mmol/l) per minute	Adjust DOWN -- current value minus **100 mg/dl** *Actual Range: 90-150 mg/dl*

The most conservative response to down arrows is to delay insulin administration until the trend arrow turns horizontal.

Pettus J, Eldeman SV: *J Diab Sci Tech* 2017

nuove indicazioni basate su previsione



➔ Dopo 30 min avremo glicemia tra 50 e 80 mg/dL (=60 mg/dL secondo Pettus/Eldeman)

SE: target = 110 mg/dL
FSI = 50 mg/dL/U
CHO:I = 15 g/U
pasto con 45 g di CHO

➔ 3.0U – 1.0U = **2.0U**

MA: **eat first and**

Adjusted Glucose Value for Dosing	
Glucose is not increasing/decreasing >1 mg/dl (0.06 mmol/l) per min	No Adjustment. Dose for current glucose value.
Glucose increasing 1-2 mg/dl (0.06-0.11 mmol/l) per minute	Adjust UP -- current value plus **50 mg/dl** *Actual Range: 30-60 mg/dl*
Glucose increasing 2-3 mg/dl (0.11-0.17 mmol/l) per minute	Adjust UP -- current value plus **75 mg/dl** *Actual Range: 60-90 mg/dl*
Glucose increasing >3 mg/dl (0.17 mmol/l) per minute	Adjust UP -- current value plus **100 mg/dl** *Actual Range: 90-150 mg/dl*
Glucose decreasing 1-2 mg/dl (0.06-0.11 mmol/l) per minute	Adjust DOWN -- current value minus **50 mg/dl** *Actual Range: 30-60 mg/dl*
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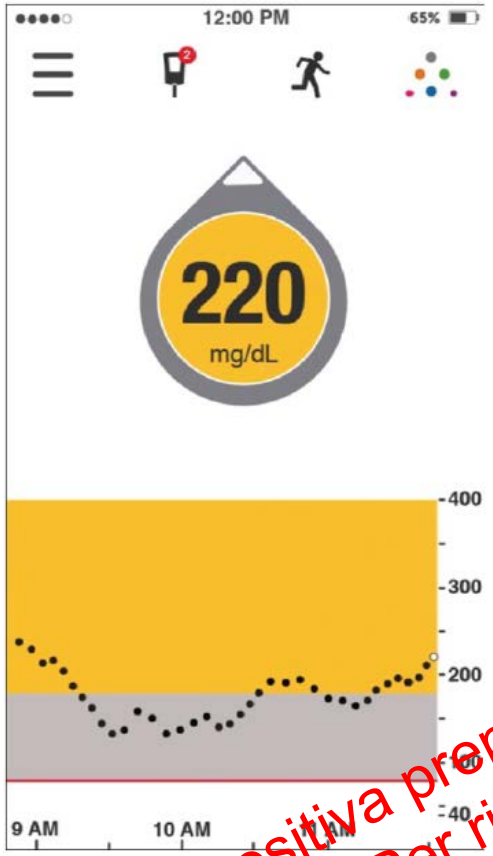
The most conservative response to down arrows is to delay insulin administration until the trend arrow turns horizontal.

Pettus J, Eldeman SV: *J Diab Sci Tech* 2017

nuove indicazioni basate su previsione



*In situations where the glucose is rising more rapidly (1 or 2 UP arrows), it is sometimes recommended that the patient administer the insulin but wait to eat the meal until the ROC arrows start to angle or level off, indicating the rate of change of glucose is slowing down. This strategy is referred to as "**waiting for the bend**"*

Adjusted Glucose Value for Dosing	
→ Glucose is not increasing/decreasing >1 mg/dl (0.06 mmol/l) per min	No Adjustment. Dose for current glucose value.
↗ Glucose increasing 1-2 mg/dl (0.06-0.11 mmol/l) per minute	Adjust UP -- current value plus **50 mg/dl** *Actual Range: 30-60 mg/dl*
↑ Glucose increasing 2-3 mg/dl (0.11-0.17 mmol/l) per minute	Adjust UP -- current value plus **75 mg/dl** *Actual Range: 60-90 mg/dl*
↑↑ Glucose increasing >3 mg/dl (0.17 mmol/l) per minute	Adjust UP -- current value plus **100 mg/dl** *Actual Range: 90-150 mg/dl*
↘ Glucose decreasing 1-2 mg/dl (0.06-0.11 mmol/l) per minute	Adjust DOWN -- current value minus **50 mg/dl** *Actual Range: 30-60 mg/dl*
↓ Glucose decreasing 2-3 mg/dl (0.11-0.17 mmol/l) per minute	Adjust DOWN -- current value minus **75 mg/dl** *Actual Range: 60-90 mg/dl*
↓↓ Glucose decreasing >3 mg/dl (0.17 mmol/l) per minute	Adjust DOWN -- current value minus **100 mg/dl** *Actual Range: 90-150 mg/dl*

The most conservative response to down arrows is to delay insulin administration until the trend arrow turns horizontal.

Pettus J, Eldeman SV: *J Diab Sci Tech* 2017

nuove indicazioni basate su previsione

- Esercizio fisico precedente (↓)
- Esercizio fisico pianificato (↓)
- Composizione del pasto
  - Solo CHO (=)
  - Con grassi e proteine (↑)
- Insulina attiva (↓)

Adjusted Glucose Value for Dosing	
Glucose is not increasing/decreasing >1 mg/dl (0.06 mmol/l) per min	No Adjustment. Dose for current glucose value.
Glucose increasing 1-2 mg/dl (0.06-0.11 mmol/l) per minute	Adjust UP -- current value plus **50 mg/dl** *Actual Range: 30-60 mg/dl*
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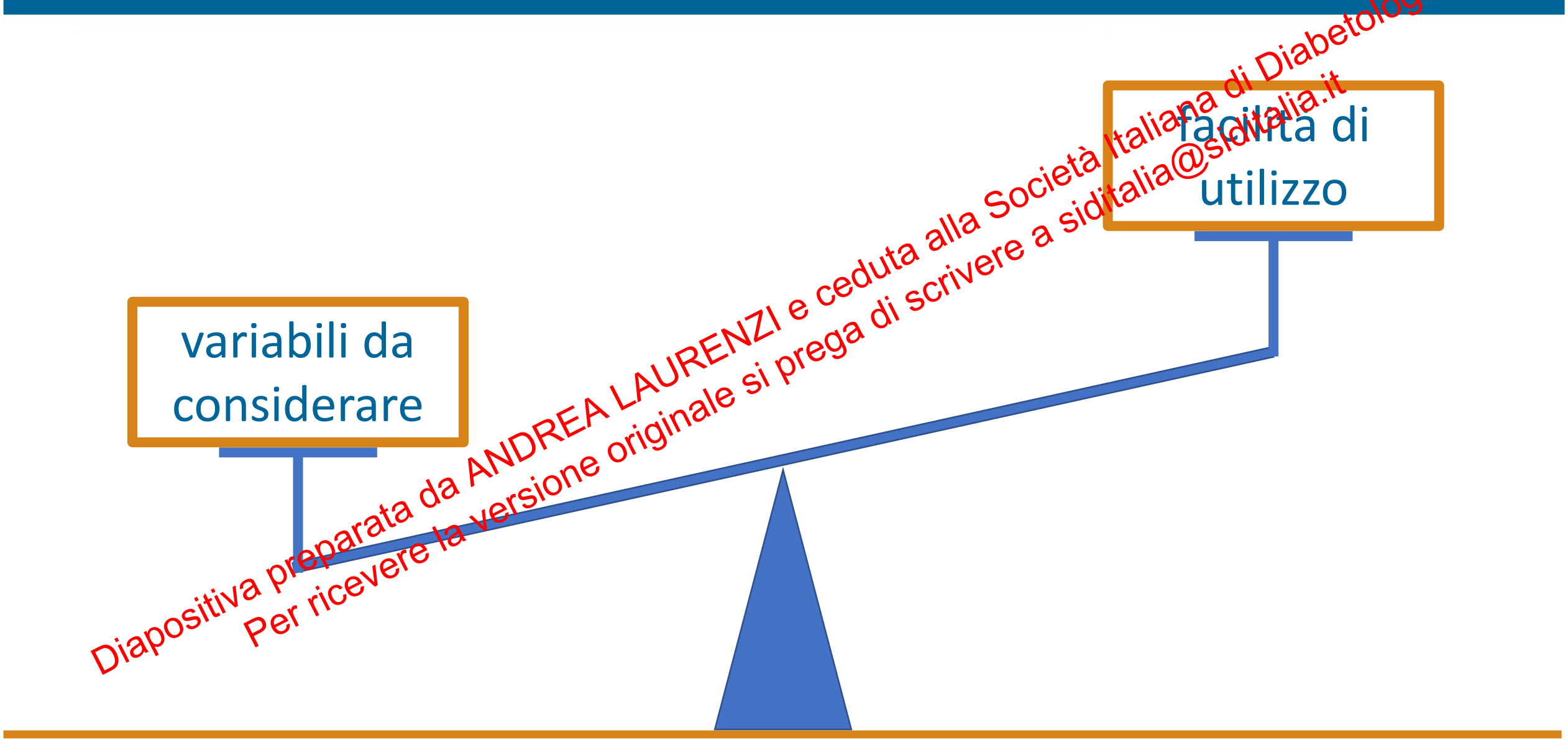
The most conservative response to down arrows is to delay insulin administration until the trend arrow turns horizontal.

Pettus J, Eldeman SV: *J Diab Sci Tech* 2017

un problema di equilibrio



per semplificare

A Simplified Approach Using Rate of Change Arrows to Adjust Insulin With Real-Time Continuous Glucose Monitoring

David C. Klonoff, MD, FACP, FRCPE, Fellow AIMBE[1] and David Kerr, MD, FRCPE[2]

Rate of change (mg/dl/min)	JDRF/DirecNet 2008	Pettus/Edelman Survey 2015[19-21]	Scheiner Protocol 2015*[22]	Pettus/Edelman Protocol 2017*[23]
Rising 1-2 mg/dl/min	↑ 10%	—	Current glu value (no Δ)	Current glu value + 50
Rising 2-3 mg/dl/min	↑ 20%	111% higher	Current glu value + 25	Current glu value + 75
Rising >3 mg/dl/min	↑ 20%	140% higher	Current glu value + 50	Current glu value + 100
Change <1 mg/dl/min	No Δ	—		
Falling 1-2 mg/dl/min	↓ 10%	—	Current glu value (no Δ)	Current glu value – 50
Falling 2-3 mg/dl/min	↓ 20%	40% lower	Current glu value – 25	Current glu value – 75
Falling >3 mg/dl/min	↓ 20%	42% lower	Current glu value – 50	Current glu value – 100

Klonoff DC, Kerr D, *J Diab Sci Tech* 2017

per semplificare

1) I rates of change previsti vengono semplificati tenendo conto del punto medio:
   - 1-2 mg/dl/min: 1.5 mg/dl/min
   - 2-3 mg/dl/min: 2.5 mg/dl/min
   - >3 mg/dl/min: >3 mg/dl/min
2) La proiezione della glicemia attuale viene fatta a 45 minuti (media tra 30 e 60 min)
3) Segue che la glicemia dopo 45 min cambierà di:
   - 1-2 mg/dl/min: 67 mg/dl
   - 2-3 mg/dl/min: 112 mg/dl
   - >3 mg/dl/min: >135 mg/dl
4) Tendendo conto di una FSI media nella popolazione adulta di 40 mg/dL/U (Walsh et al, *Diab Sci Tech* 2010) e ipotizzando (a scopo cautelativo) una FSI tra 67 e 75 mg/dL/U le unità di insulina da variare sarebbero:
   - 1-2 mg/dl/min: **1.0U**
   - 2-3 mg/dl/min: **1.5U**
   - >3 mg/dl/min: **2.0U**

Klonoff DC, Kerr D, *J Diab Sci Tech* 2017

esempio

- Glicemia pre-pasto di 190 mg/dL
- FSI di 40 mg/dL/U
- CHO:I di 15g/U
- Pasto con 90g di CHO
- ROC di 1-2 mg/dL/min in salita (↗)

Per il pasto: 6.0U

Correzione della glicemia: +1.5U → **8.5U**

Correzione della ROC: +1.0U

una variabile in più: il FSI

A Practical Approach to Using Trend Arrows on the CGM System for the Management of Adults With Diabetes

Grazia Aleppo,[1] Lori M. Laffel,[2] Andrew J. Ahmann,[3] Irl B. Hirsch,[4] Davida F. Kruger,[5] Anne Peters,[6] Ruth S. Weinstock,[7] and Dennis R. Harris[8]

Trend Arrows		Correction Factor* (CF)	Insulin Dose Adjustment (U)
Receiver	App		
⇈		<25 25–<50 50–<75 ≥75	+4.5 +3.5 +2.5 +1.5
↑		<25 25–<50 50–<75 ≥75	+3.5 +2.5 +1.5 +1.0
↗		<25 25–<50 50–<75 ≥75	+2.5 +1.5 +1.0 +0.5
→		<25 25–<50 50–<75 ≥75	No adjustment No adjustment No adjustment No adjustment
↘		<25 25–<50 50–<75 ≥75	-2.5 -1.5 -1.0 -0.5
↓		<25 25–<50 50–<75 ≥75	-3.5 -2.5 -1.5 -1.0
⇊		<25 25–<50 50–<75 ≥75	-4.5 -3.5 -2.5 -1.5

Da considerare per aggiustamenti:

- del bolo pre-pasto
- del bolo correttivo se oltre le 4 ore dal pasto precedente.

Aleppo G et al, *Journal of the Endocrine Society*, Dec 2017

esempio

- Glicemia pre-pasto di 190 mg/dL
- FSI di 40 mg/dL/U
- CHO:I di 15g/U
- Pasto con 90g di CHO
- ROC di 1-2 mg/dL/min in salita (↗)

Per il pasto: 6.0U

Correzione della glicemia: +1.5U → **9.0U**

ROC in base a FSI: +1.5U

Trend Arrows		Correction Factor* (CF)	Insulin Dose Adjustment (U)
Receiver	App		
⇈		<25	+4.5
		25–<50	+3.5
		50–<75	+2.5
		≥75	+1.5
↑		<25	+3.5
		25–<50	+2.5
		50–<75	+1.5
		≥75	+1.0
↗		<25	+2.5
		25–<50	+1.5
		50–<75	+1.0
		≥75	+0.5
→		<25	No adjustment
		25–<50	No adjustment
		50–<75	No adjustment
		≥75	No adjustment
↘		<25	-2.5
		25–<50	-1.5
		50–<75	-1.0
		≥75	-0.5
↓		<25	-3.5
		25–<50	-2.5
		50–<75	-1.5
		≥75	-1.0
⇊		<25	-4.5
		25–<50	-3.5
		50–<75	-2.5
		≥75	-1.5

un'altra variabile: il range glicemico

diabete di tipo 1

Scorecard Type 1 diabetes				Glucose level												
				<70 mg/dL[a] <3.9 mmol/L	70-180 mg/dL 3.9-10 mmol/L				180-250 mg/dL 10-13.9 mmol/L				>250 mg/dL >13.9 mmol/L				Ketone positive[b]
Change					Correction factor mg/dL mmol/L				Correction factor mg/dL mmol/L				Correction factor mg/dL mmol/L				
					<25 <1.4	25-<50 1.4-<2.8	50-<75 2.8-<4.2	>75 >4.2	<25 <1.4	25-<50 1.4-<2.8	50-<75 2.8-<4.2	>75 >4.2	<25 <1.4	25-<50 1.4-<2.8	50-<75 2.8-<4.2	>75 >4.2	
					Insulin units				Insulin units				Insulin units				
	↑↑	↑↑↑	CU		+3.5	+2.5	+1.5	+1	+4.5	+3.5	+2.5	+1.5	+5	+4	+3	+2	Max corr[b]
↑	↑	↑↑			+2.5	+2	+1	+0.5	+3.5	+2.5	+1.5	+1	+4	+3	+2	+1.5	Max corr[b]
↗	↗	↑			+1.5	+1	+0.5	+0.5	+2 .5	+1.5	+1	+0.5	+3	+2	+1.5	+1	Max corr[b]
→	→		1 fast-acting CU		+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	Max corr[b]
↘	↘	↓	2 fast-acting CUs		−2.5	−1.5	−1	−0.5	−2	−1	−0.5	−0.5	−2.5	−1	−0.5	−0	Max corr[b]
↓	↓	↓↓	2 fast-acting CUs		−3.5	−2.5	−1.5	−1	−3	−2	−1	−1	−3.5	−2	−1	−0.5	Max corr[b]
	↓↓	↓↓↓	2 fast-acting CUs		−4.5	−3.5	−2.5	−1.5	−4	−3	−1.5	−1	−4	−2.5	−1	−0.5	Max corr[b]

Ziegler R et al, *J Diab Sci Tech*, 2019

un'altra variabile: il range glicemico

diabete di tipo 2

Scorecard Insulin-dependent type 2 diabetes				Glucose level								
				<70 mg/dL[a] <3.9 mmol/L	70-180 mg/dL 3.9-10 mmol/L			180-250 mg/dL 10-13.9 mmol/L			>250 mg/dL >13.9 mmol/L	
Change					Correction factor mg/dL mmol/L			Correction factor mg/dL mmol/L			Correction factor mg/dL mmol/L	
					≤10 ≤0.6	>10-<30 >0.6-<1.7	>30->50 >1.7-<2.8	≤10 ≤0.6	>10-<30 >0.6-<1.7	>30->50 >1.7-<2.8	≤10 ≤0.6	>10-<30 >0.6-<1.7	>30->50 >1.7-<2.8
					Insulin units			Insulin units			Insulin units	
	↑↑	↑↑↑	CU		+4	+3	+6	+5	+4	+7	+6	+5
↑	↑	↑↑			+3	+2	+5	+4	+3	+6	+5	+4
↗	↗	↑			+2	+1	+4	+3	+2	+5	+4	+3
→	→		1 fast-acting CU	+0	+0	+0	+0	+0	+0	+0	+0	+0
↘	↘	↓	2 fast-acting CUs	−3	−2	−1	−3	−2	−1	−3	−2	−1
↓	↓	↓↓	2 fast-acting CUs	−4	−3	−2	−4	−3	−2	−4	−3	−2
	↓↓	↓↓↓	2 fast-acting CUs	−5	−4	−3	−5	−4	−3	−5	−4	−3

Ziegler R et al, *J Diab Sci Tech*, 2019

esempio

Scorecard Type 1 diabetes				Glucose level												
				<70 mg/dL[a] <3.9 mmol/L	70-180 mg/dL 3.9-10 mmol/L				180-250 mg/dL 10-13.9 mmol/L				>250 mg/dL >13.9 mmol/L				Ketone positive[b]
Change					Correction factor mg/dL mmol/L				Correction factor mg/dL mmol/L				Correction factor mg/dL mmol/L				
					<25 <1.4	25-<50 1.4-<2.8	50-<75 2.8-<4.2	>75 >4.2	<25 <1.4	25-<50 1.4-<2.8	50-<75 2.8-<4.2	>75 >4.2	<25 <1.4	25-<50 1.4-<2.8	50-<75 2.8-<4.2	>75 >4.2	
					Insulin units				Insulin units				Insulin units				
	↑↑	↑↑↑	CU		+3.5	+2.5	+1.5	+1	+4.5	+3.5	+2.5	+1.5	+5	+4	+3	+2	Max corr[b]
↑	↑	↑↑			+2.5	+2	+1	+0.5	+3.5	+2.5	+1.5	+1	+4	+3	+2	+1.5	Max corr[b]
↗	↗	↑			+1.5	+1	+0.5	+0.5	+2 .5	+1.5	+1	+0.5	+3	+2	+1.5	+1	Max corr[b]
→	→		1 fast-acting CU		+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	+0	Max corr[b]
↘	↘	↓	2 fast-acting CUs		−2.5	−2	−1	−0.5	−2	−1	−0.5	−0.5	−2.5	−1	−0.5	−0	Max corr[b]
↓	↓	↓↓	2 fast-acting CUs		−3.5	−2.5	−1.5	−1	−3	−2	−1	−1	−3.5	−2	−1	−0.5	Max corr[b]
	↓↓	↓↓↓	2 fast-acting CUs		−4.5	−3.5	−2.5	−1.5	−4	−3	−1.5	−1	−4	−2.5	−1	−0.5	Max corr[b]

Per il pasto: 6.0U

Correzione della glicemia: +1.5U ➡ **9.0U**

ROC in base a FSI: +1.5U

per l'isCGM

Approach to Using Trend Arrows in the Glucose Monitoring Systems in Adults

Yogish C. Kudva,[1] Andrew J. Ahmann,[2] Richard M. Bergenstal,[3] James R. Gavin III,[4] Davida F. Kruger,[5] L. Kurt Midyett,[6] Eden Miller,[7] and Dennis R. Harris[8]

- Rivolto a pazienti che usano isCGM (senza allarmi)
- Applicabile per pazienti sia con DMT1 che con DMT2
- Focus particolare su indicazioni per pazienti in MDI
- Nelle precedenti proposte mancanza di indicazioni precise per il periodo post-prandiale (entro le 4 ore dal bolo) e nelle situazioni particoli (es. esercizio fisico)

Kudva YC, *Journal of the Endocrine Society*, Dec 2018

per l'isCGM

Insulin Dose Adjustments Using the FreeStyle Libre System Trend Arrows in Adults: Pre-meal and Corrections ≥4 Hours Post-meal

FreeStyle Libre Trend Arrows	Insulin Dose Adjustments: Correction Factor* (CF)			
	<25	25–<50	50–<75	≥75
↑	+3.5 units	+2.5 units	+1.5 units	+1.0 units
↗	+2.5 units	+1.5 units	+1.0 units	+0.5 units
→	No adjustment	No adjustment	No adjustment	No adjustment
↘	-2.5 units	-1.5 units	-1.0 units	-0.5 units
↓	-3.5 units	-2.5 units	-1.5 units	-1.0 units

Insulin dose adjustments using trend arrows do not replace standard calculations using ICR and CF. Adjustments are increases or decreases of rapid-acting insulin in addition to calculations using ICR and CF. Adjustments using trend arrows are an additional step to standard care.

*Correction factor (CF) is in mg/dL and indicates glucose lowering per unit of rapid-acting insulin.

Kudva YC, *Journal of the Endocrine Society*, Dec 2018

per l'isCGM

Considerations
Mealtime is ideal to begin applying insulin dose adjustments using trend arrows. For the 4 hours following a meal, refer to *Figure 3* for an approach to minimize hypo- and hyperglycemia during this timeframe.
For rapidly rising sensor glucose (UP arrow; ↑) at pre-meal, consider administering insulin 15–30 minutes before eating.
For rapidly falling sensor glucose (DOWN arrow; ↓): • Pre-meal: consider administering insulin closer to the meal • Near or lower than 150 mg/dL: consider holding pre-meal insulin dose until glucose trends have stabilized

Kudva YC, *Journal of the Endocrine Society*, Dec 2018

per l'isCGM

2–4 hr Post-meal Glucose Concentration	
>250 mg/dL	
FreeStyle Libre Trend Arrows	**Action**
↑	Take corrective action using bolus insulin dose based on CF. Re-scan in 1 hour. If up arrow persists after additional hour: • Confirm with fingerstick • Change infusion site (if using an insulin pump) • Take additional corrective insulin dose based on CF
↗	Take corrective action using bolus insulin dose based on CF. Re-scan in 1 hour. Avoid additional correction doses for 2 hours.
→	No action needed. Rescan in 1 hour.
↘	No action needed. Rescan in 1 hour.
↓	No action needed. Rescan in 1 hour.

181–250 mg/dL	
↑	Consider corrective action using bolus insulin dose based on CF. Re-scan in 1 hour. Avoid additional correction doses for 2 hours.
↗	Consider corrective action using bolus insulin dose based on CF. Re-scan in 1 hour. Avoid additional correction doses for 2 hours.
→	No action needed. Rescan in 1 hour.
↘	No action needed. Rescan in 30 minutes.
↓	No action needed. Rescan in 30 minutes.

70–180 mg/dL	
↑	No action needed. Rescan in 1 hour.
↗	No action needed. Rescan in 1 hour.
→	No action needed. Rescan in 1 hour.
↘	Ingest 15 g fast-acting carbohydrate. Re-scan in 15–30 min. If sensor glucose ≤70 mg/dL with downward arrow at 30 min, confirm with fingerstick and ingest additional 15 g fast-acting carbohydrate.
↓	Ingest 15 g fast-acting carbohydrate. Re-scan in 15–30 min. If sensor glucose ≤70 mg/dL with downward arrow at 30 min, confirm with fingerstick and ingest additional 15 g fast-acting carbohydrate.
Corrective action is necessary for sensor glucose readings at or below 70 mg/dL when downward arrows are present. Following corrective action, rescanning is needed to ensure the sensor glucose reading is trending toward an acceptable range.	

Considerations
• Flat arrows indicate that glucose concentrations are changing very slowly at a rate of less than 1 mg/dL/min. For individuals using the systems, more frequent scanning may be warranted to monitor for hypoglycemia when a flat arrow is present and sensor glucose is near the low-end of target range. • CSII-treated individuals should use established CF with the pump bolus calculator, which will account for insulin-on-board. • MDI-treated individuals that are not using a bolus calculator that takes insulin-on-board into consideration are generally recommended to administer 50% of the calculated insulin dose during this timeframe to avoid hypoglycemia. • Confirmatory fingerstick is indicated: ◦ During times of rapidly changing glucose of more than 2 mg/dL/min (i.e., straight up or down arrow) ◦ To confirm hypoglycemia or impending hypoglycemia as reported by the sensor

Kudva YC, *Journal of the Endocrine Society*, Dec 2018

per l'isCGM

Pre-Exercise Planning for Aerobic and Mixed Exercise Using Trend Arrows in the FreeStyle Libre Systems			
Pre-Exercise Glucose Concentration			
<100 mg/dL	**100–180 mg/dL**	**181–250 mg/dL**	**>250 mg/dL**
DO NOT Exercise *Ingest carbohydrate and/or wait until >100 mg/dL*	**Exercise Carefully** *Rescan every 30 minutes to avoid hypoglycemia*	**Exercise** *Rescan every 60 minutes to avoid hypoglycemia*	**DO NOT Exercise** *Correct and/or wait until ≤250 mg/dL*
↑ Wait until >100 mg/dL	↑ Rescan in 30 min	↑ Rescan in 30 min	↑ Correct to ≤180 mg/dL
↗ Wait until >100 mg/dL	↗ Rescan in 30 min	↗ Rescan in 30 min	↗ Correct to ≤180 mg/dL
→ Ingest 15 g carbohydrate	→ Consider ingesting 15 g carbohydrate*	→ Rescan in 30 min	→ Correct to ≤180 mg/dL
↘ Ingest 15 g carbohydrate	↘ Consider ingesting 15 g carbohydrate*	↘ Rescan in 30 min	↘ Wait until ≤250 mg/dL
↓ Ingest 30 g carbohydrate	↓ Consider ingesting 30 g carbohydrate*	↓ Consider ingesting 15 g carbohydrate	↓ Wait until ≤250 mg/dL

Kudva YC, *Journal of the Endocrine Society*, Dec 2018

quali evidenze?

Livelli di prova / Prove di tipo	Livello delle raccomandazioni / Forza
I Prove ottenute da più studi clinici controllati randomizzati e/o da revisioni sistematiche di studi randomizzati **II** Prove ottenute da un solo studio randomizzato di disegno adeguato **III** Prove ottenute da studi di coorte non randomizzati con controlli concorrenti o storici o loro metanalisi **IV** Prove ottenute da studi retrospettivi tipo caso-controllo o loro metanalisi **V** Prove ottenute da studi di casistica ("serie di casi") senza gruppo di controllo **VI** Prove basate sull'opinione di esperti autorevoli o di comitati di esperti come indicato in linee-guida o *consensus* conference, o basate su opinioni dei membri del gruppo di lavoro responsabile di queste linee-guida	**A** L'esecuzione di quella particolare procedura o test diagnostico è fortemente raccomandata. Indica una particolare raccomandazione sostenuta da prove scientifiche di buona qualità, anche se non necessariamente di tipo I o II **B** Si nutrono dei dubbi sul fatto che quella particolare procedura o intervento debba sempre essere raccomandata, ma si ritiene che la sua esecuzione debba essere attentamente considerata **C** Esiste una sostanziale incertezza a favore o contro la raccomandazione di eseguire la procedura o l'intervento **D** L'esecuzione della procedura non è raccomandata **E** Si sconsiglia fortemente l'esecuzione della procedura

conclusioni

- Le frecce di tendenza rappresentano il valore aggiunto nella gestione della glicemia per I pazienti che usano CGM
- Le proposte di interpretazione sono molteplici, al crescere del numero di variabili che considerano diminuisce la semplicità di utilizzo da parte dei pazienti
- L'educazione resta lo strumento fondamentale per ottimizzarne l'utilizzo