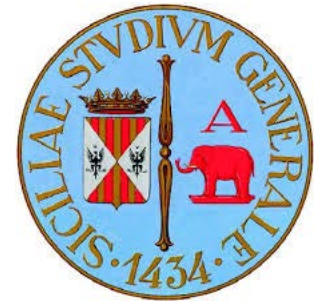




La gestione dell'anziano ricoverato

Francesco Purrello
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Diapositiva preparata da FRANCESCO PURRELLO e ceduta alla Società Italiana di Diabetologia.
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Disclosure information

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Advisory Board

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Novo Nordisk, Sanofi

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Management of Inpatient Hyperglycemia and Diabetes in Older Adults

Diabetes Care 2017;40:509–517 | DOI: 10.2337/dc160989

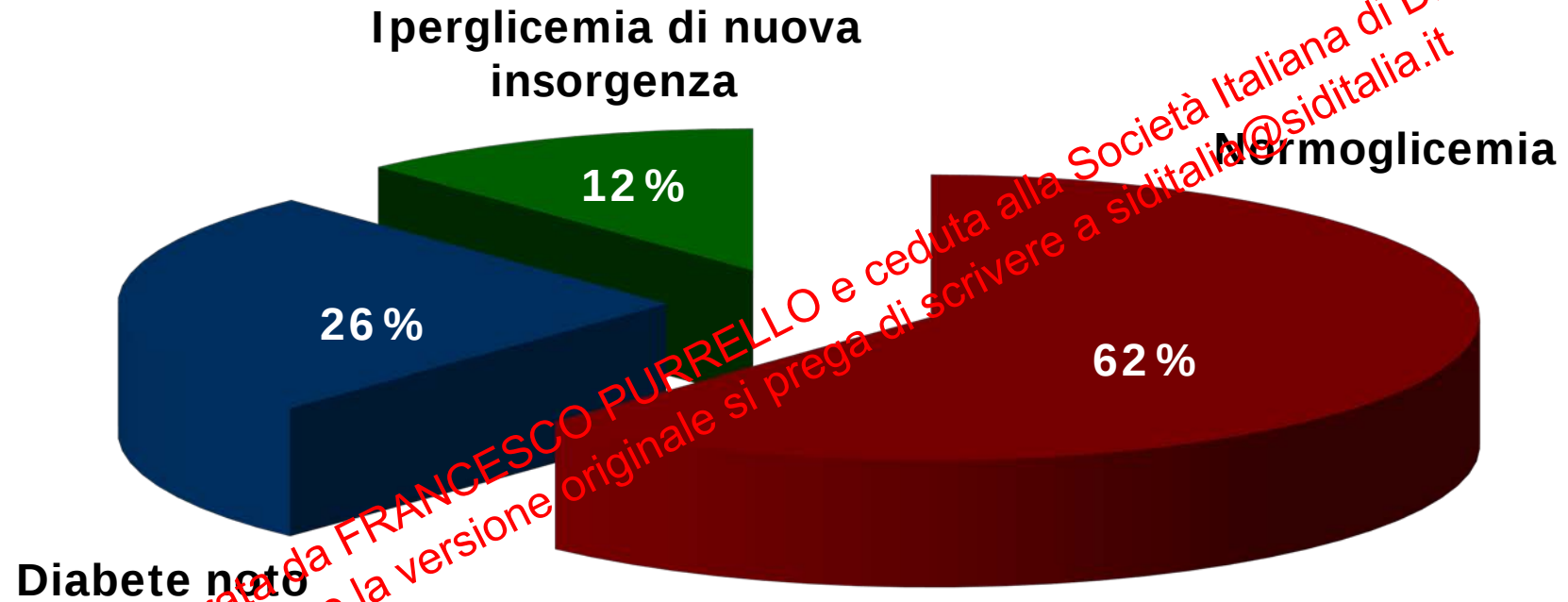
The two leading causes of hospital admissions in older adults with diabetes are **cardiovascular disorders** (coronary artery disease, angina, heart failure, and stroke) and **respiratory diseases** (pneumonia and chronic obstructive pulmonary disease). They are followed by **diseases of the digestive and genitourinary systems**, with diabetes as the primary diagnosis.

Outline

1. Clinical presentation.
2. In-patient hyperglycemia and adverse outcomes.
3. In-patient hypoglycemia.
4. Glycemic targets in hospitalized patients: moderate versus tight glycemic control?
5. Management of hyperglycemia in noncritical care settings.
6. Noninsulin therapies.

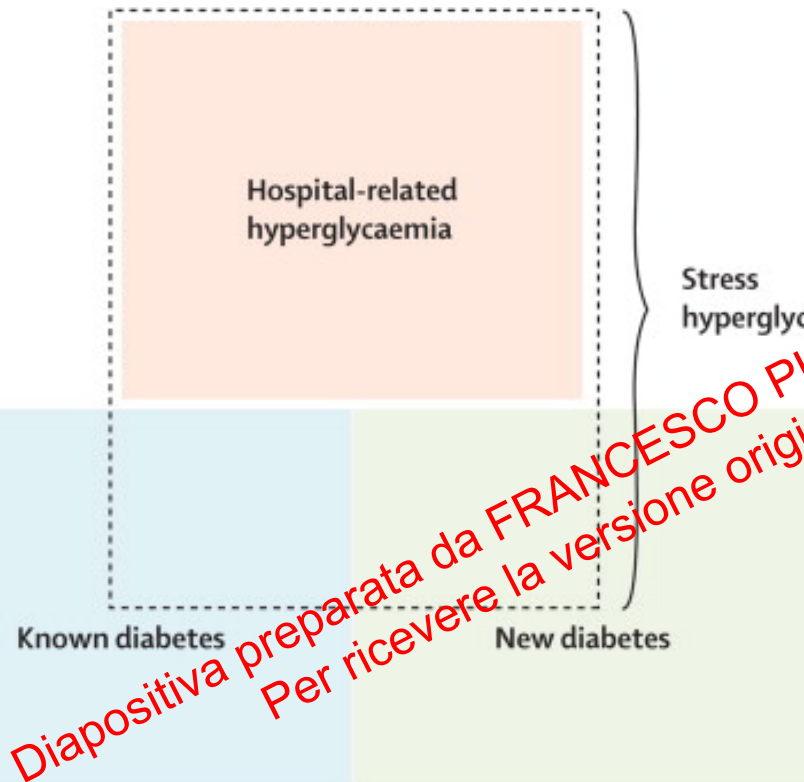
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Distribuzione della glicemia all'ingresso in ospedale



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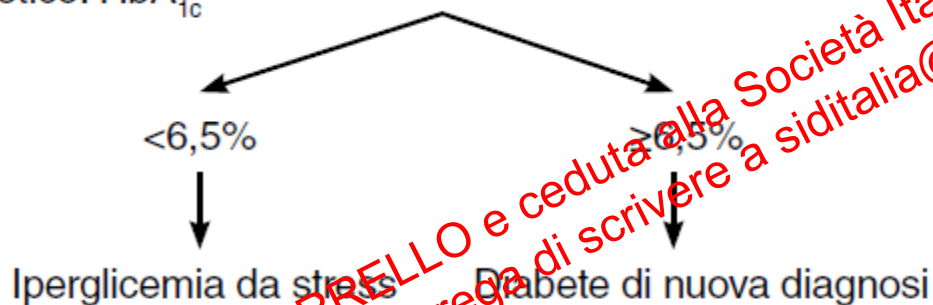
Classificazione dell'iperglicemia in ospedale



- **Diabete noto (Known diabetes)**
diabete mellito noto preesistente al ricovero.
- **Diabete non conosciuto (New Diabetes)**
diabete mellito di prima diagnosi durante la degenza e confermato dopo la dimissione.
- **Iperglicemia correlata alla degenza o iperglicemia da stress (Stress hyperglycemia):**
si tratta di persone non note come diabetiche, con un'iperglicemia comparsa per la prima volta durante il ricovero e regredita alla dimissione.

Iperglicemia da stress e iperglicemia associata a diabete

A- Paziente NON noto come diabetico: HbA_{1c}



B- Diabete noto e trattato: grado di compenso
<7% buono
>8% scadente

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Outline

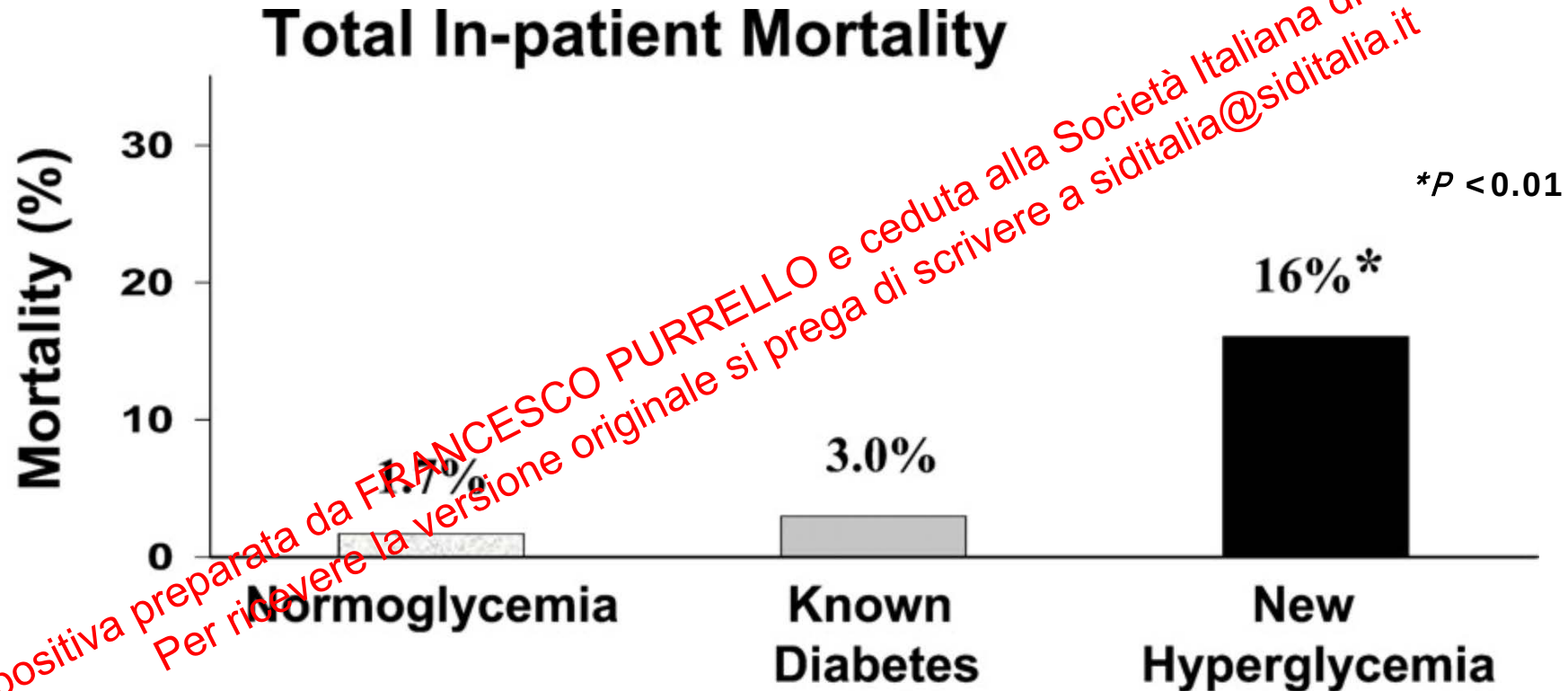
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In-hospital mortality in patients with normoglycemia, known diabetes, and newly discovered hyperglycemia

Umpierrez GE et al. J Clin Endocrinol Metab 87(3):978-982, 2002

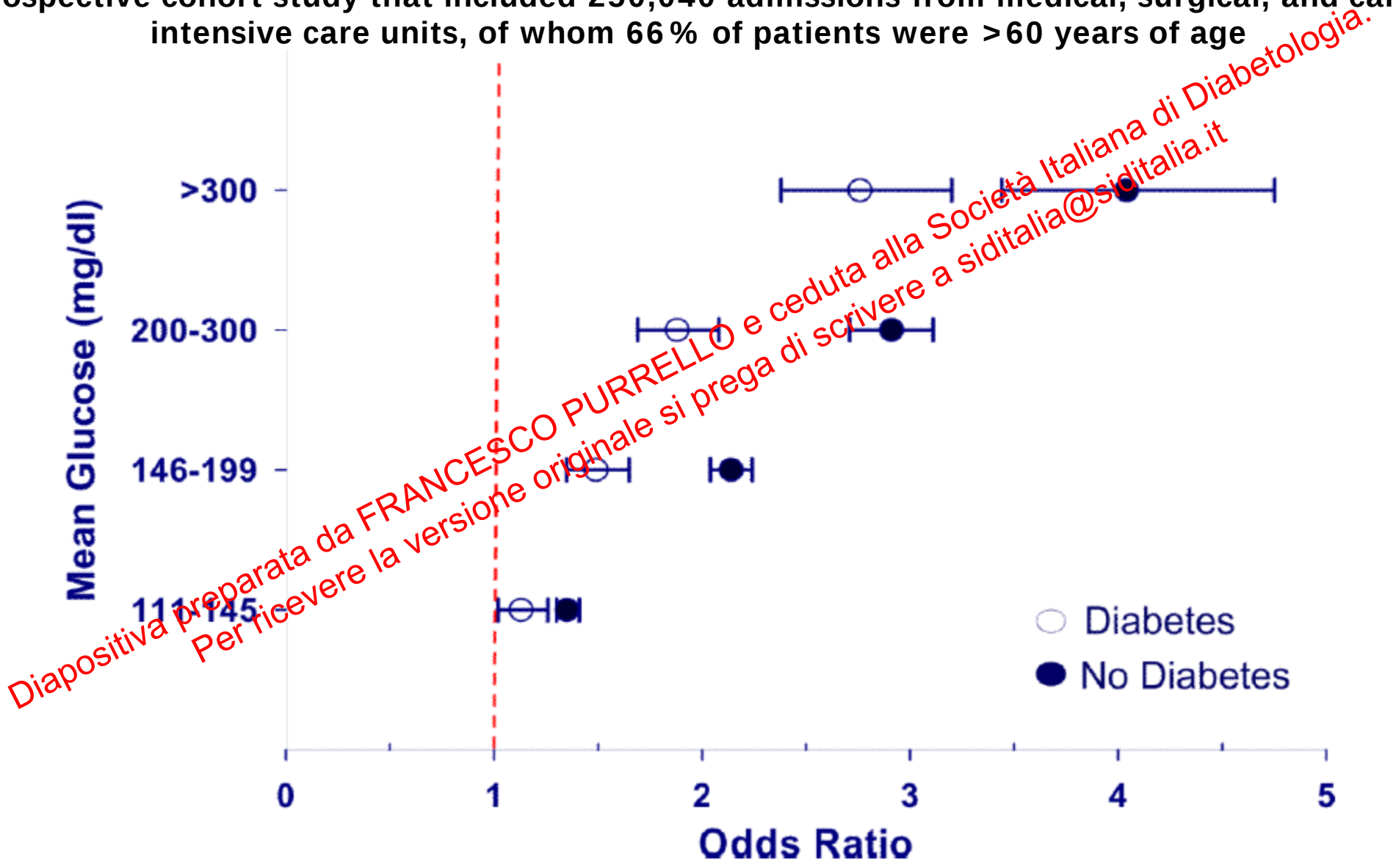
2030 consecutive adult patients



In addition, new hyperglycemic patients had a longer length of hospital stay, a higher admission rate to an intensive care unit, and were less likely to be discharged to home, frequently requiring transfer to a transitional care unit or nursing home facility.

Mortality risk from hyperglycemia in medical, surgical, and cardiac ICUs is greater in patients without a diagnosis of diabetes

Retrospective cohort study that included 250,040 admissions from medical, surgical, and cardiac intensive care units, of whom 66 % of patients were >60 years of age



Hyperglycemia as a predictor of in-hospital mortality in elderly patients without diabetes mellitus admitted to a sub-intensive care unit.

Sleiman I1, Morandi A, Sabatini T, Ranhoff A, Ricci A, Rozzini R, Trabucchi M.

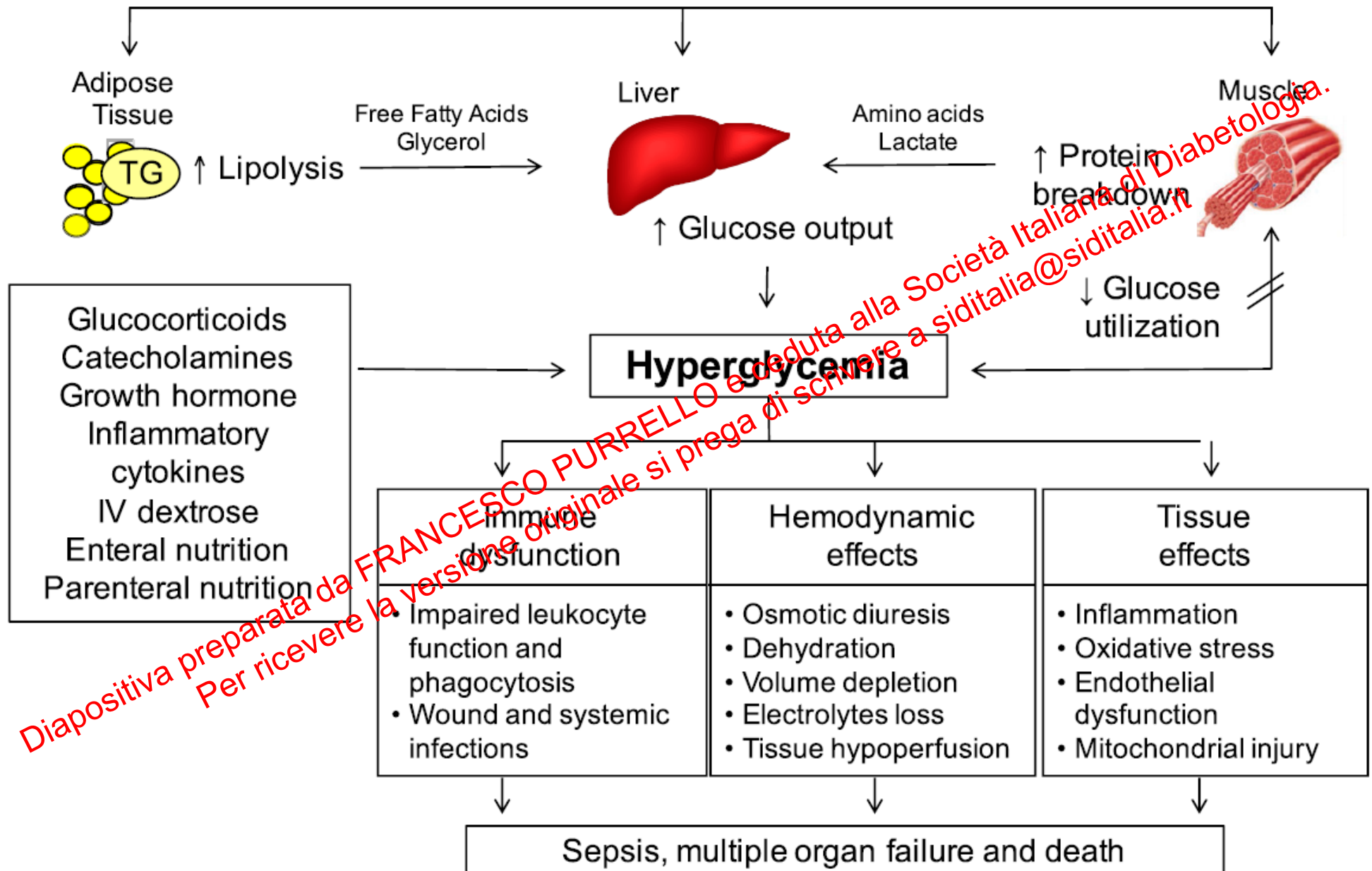
J Am Geriatr Soc. 2008 Jun;56(6):1106-10

1155 patients (mean age 79.6+/-8.4)

822 patients without a history of diabetes mellitus (DM) and 333 patients with a diagnosis of DM were selected and subdivided into three categories according to serum fasting blood glucose: 60 to 126 mg/dL (Group A), 127 to 180 mg/dL (Group B), and 181 to 500 mg/dL (Group C).

Total in-hospital mortality was 14.5%. In patients with and without DM, mortality was 8.8% and 11.3%, respectively, in Group A; 13.6% and 17.3% in Group B, and 12.6% and 34.3% in Group C

Metabolic and Hormonal Changes Leading to Stress Hyperglycemia



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Diabetes Care 2017;40:509–517

Table 1—Factors contributing to inpatient hypoglycemia in older adults with diabetes

Medications: insulin, sulfonylureas, glinides, quinolones

Intensive glycemic control

Inappropriate insulin dosing and medication errors

Poor coordination of insulin administration and food delivery

Interruption of enteral nutrition or parenteral nutrition infusion

Hypoglycemia unawareness

Renal insufficiency

Liver failure

Severe illness, sepsis

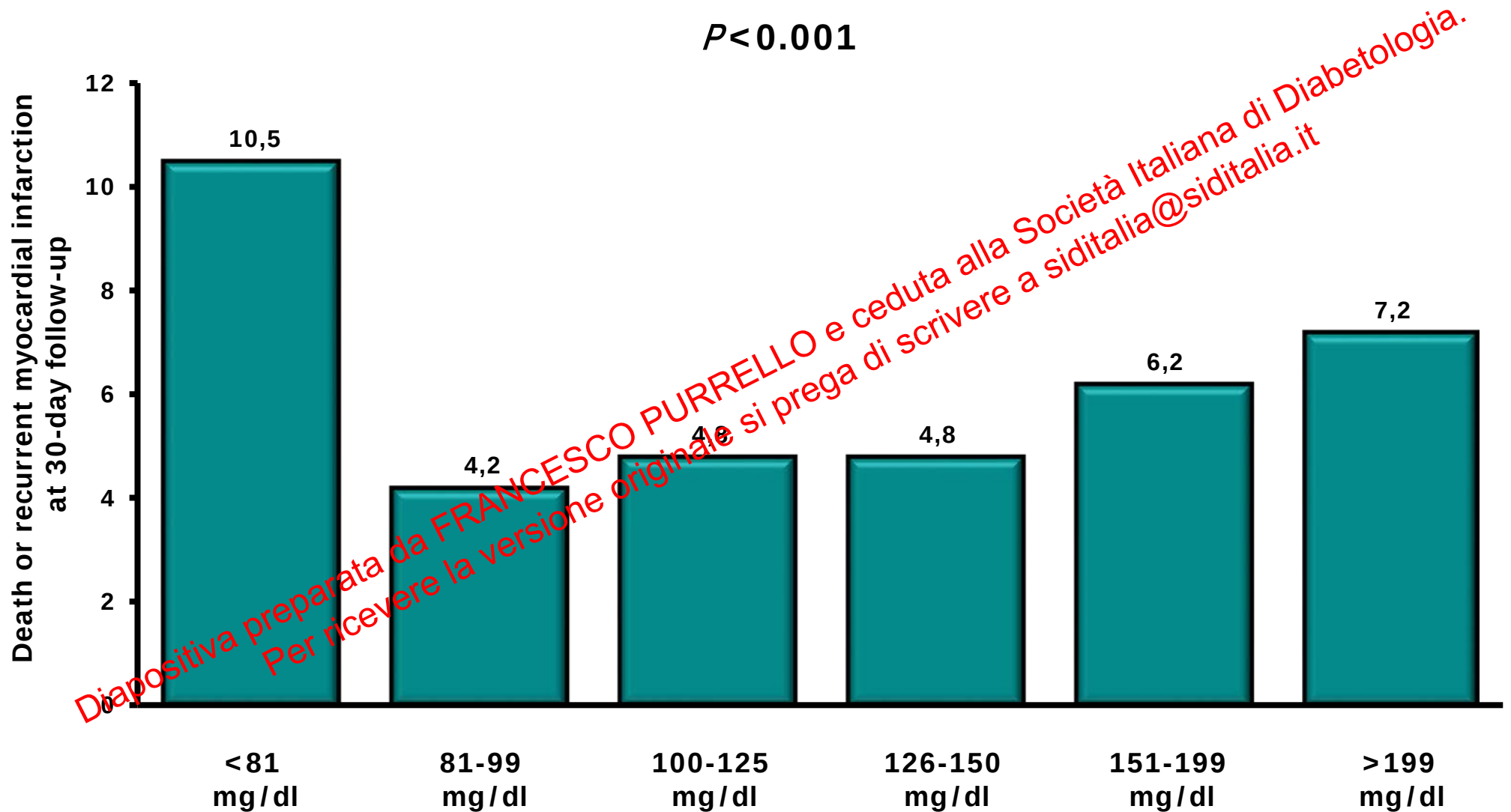
Dementia

Frailty

Medical and surgical procedures

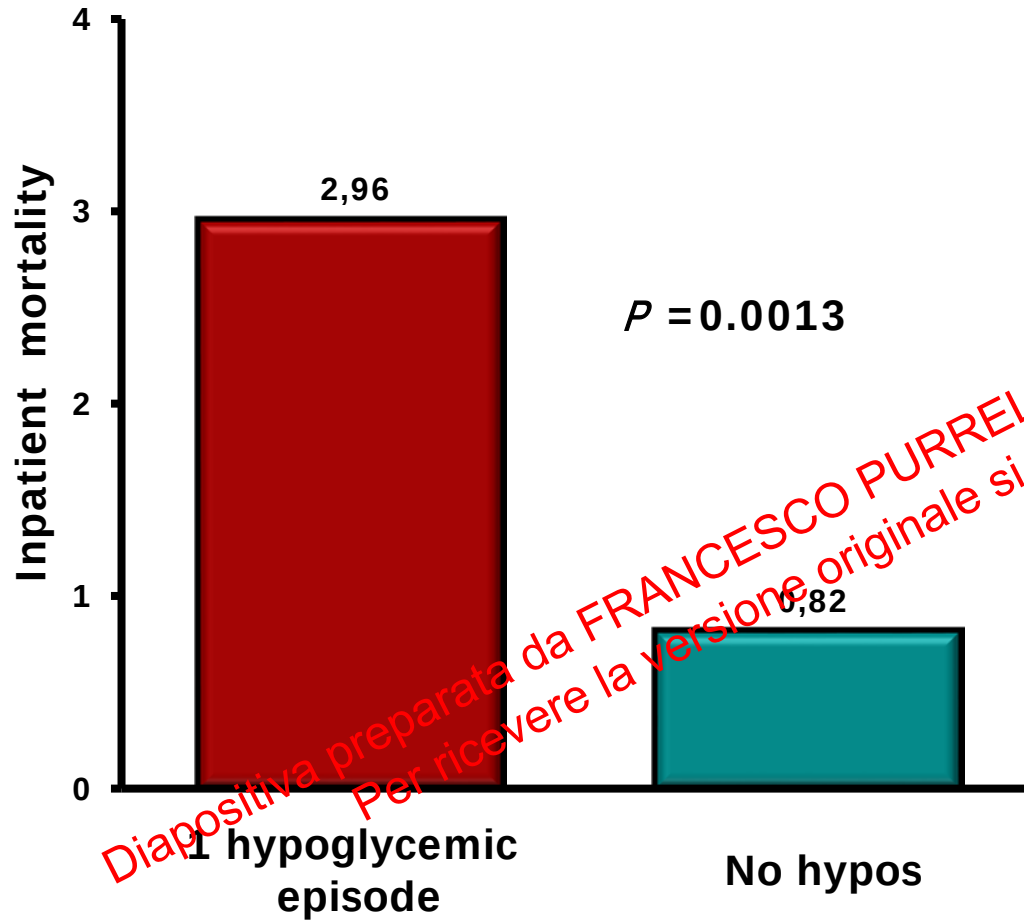
Diapositiva preparata da FRANCESCO PIRELLLO e ceduta alla Società Italiana di Diabetologia.
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U-Shaped relationship of blood glucose with adverse outcomes at 30 days in subjects with STEMI: a pooled analysis of 4224 patients

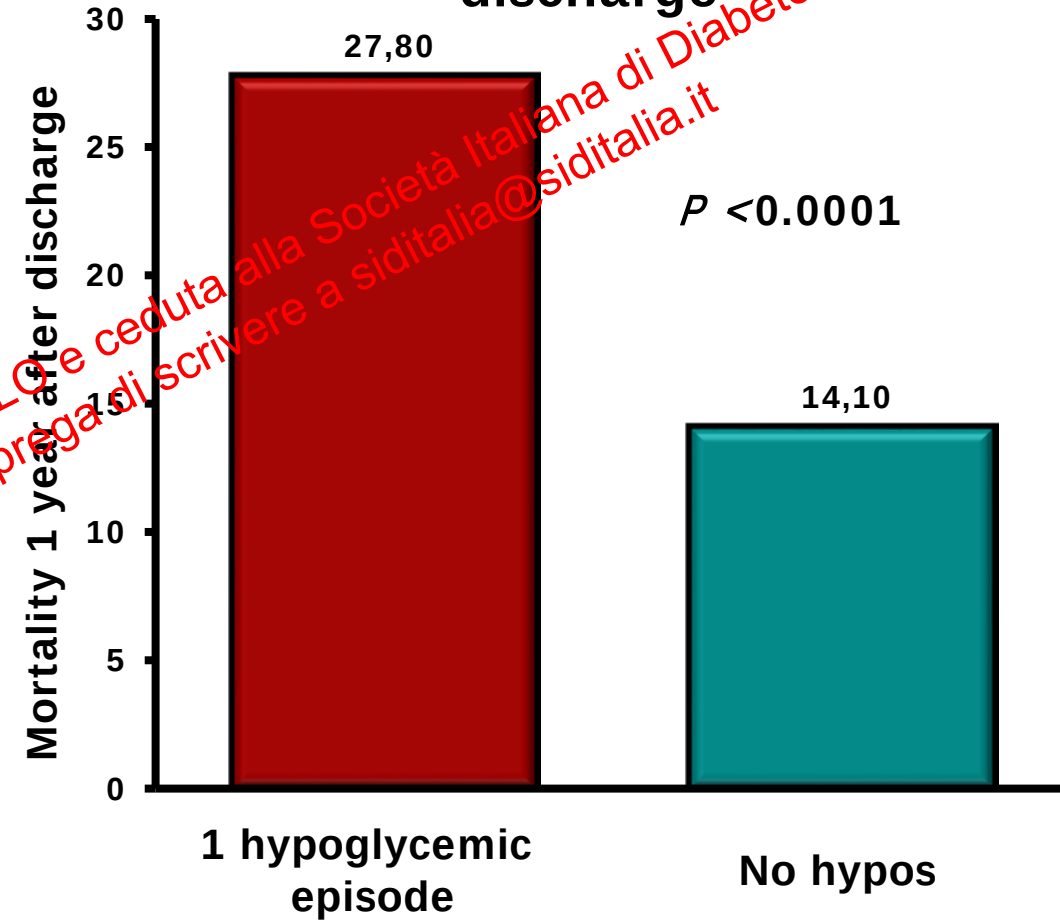


Hypoglycemia and clinical outcomes in 2582 patients with diabetes hospitalized in the general ward

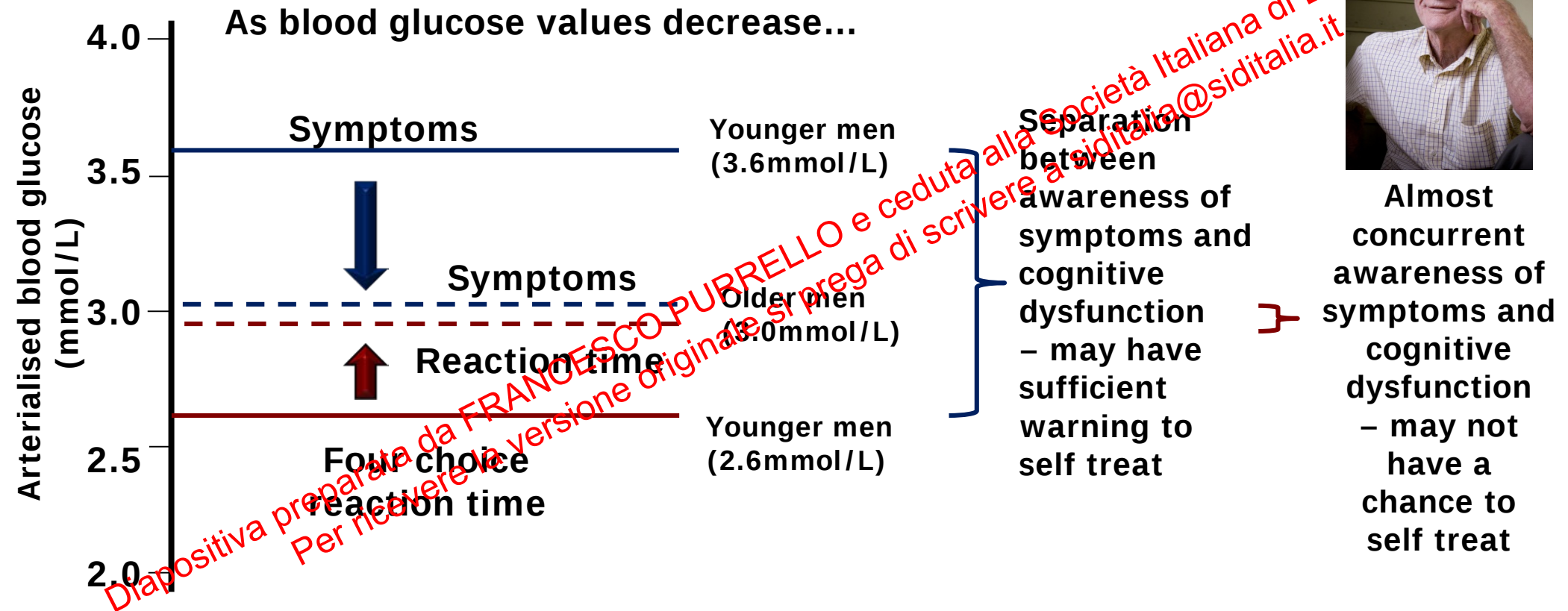
In-patient mortality



Mortality 1 year after discharge



Thresholds for hypoglycaemia awareness in elderly and young



With less advance warning of cognitive impairment when blood glucose falls, older patients may be more prone to severe hypoglycemia with sulfonylureas and insulin use

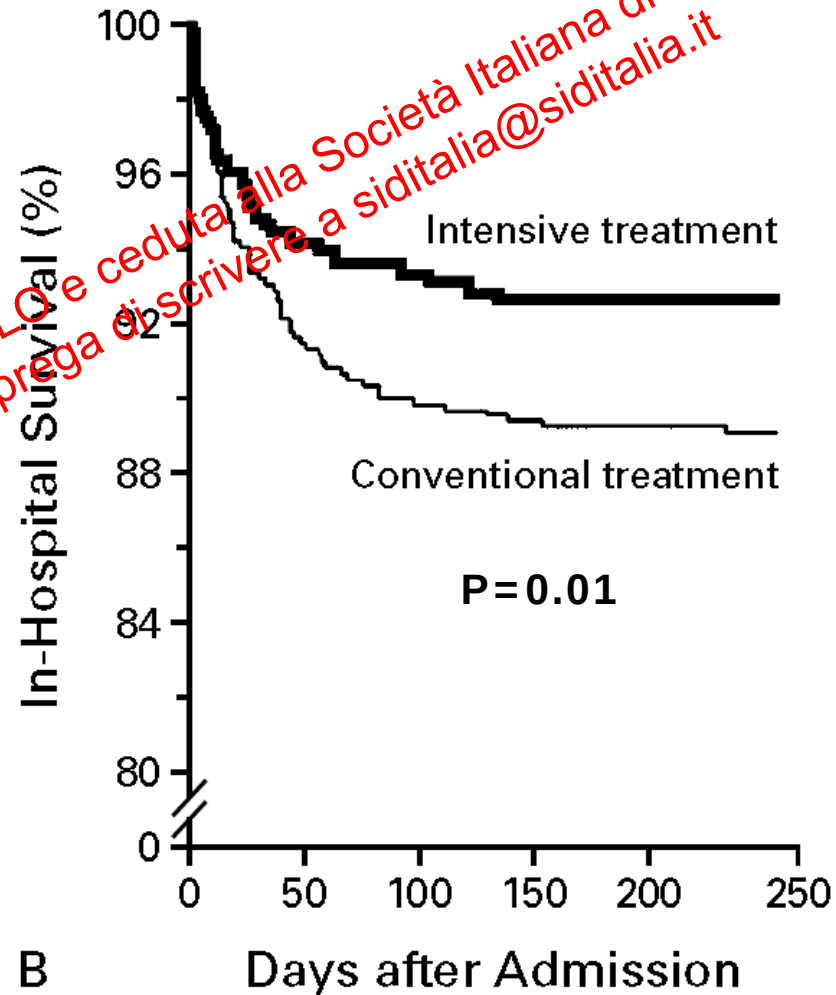
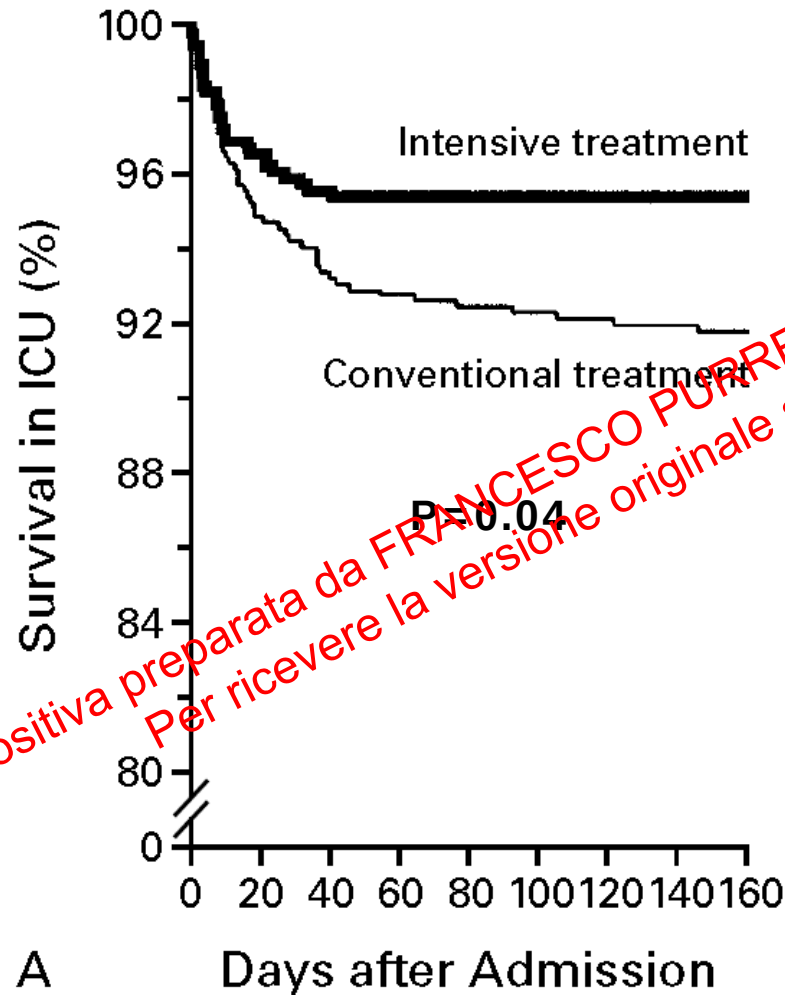
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Intensive insulin therapy in critically ill patients admitted to surgical intensive care unit

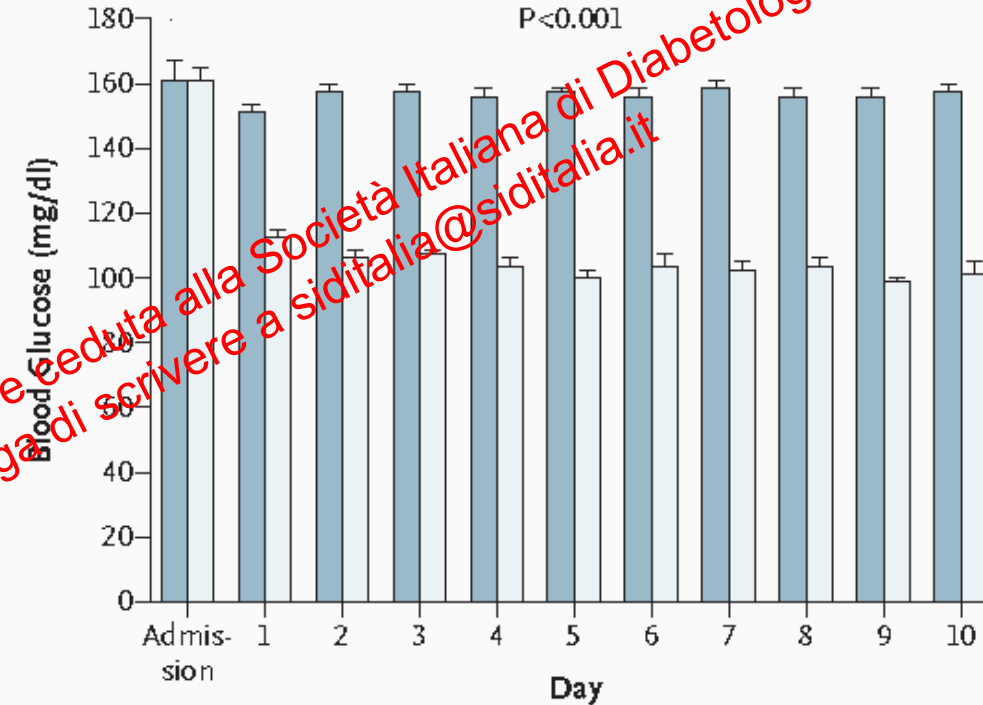
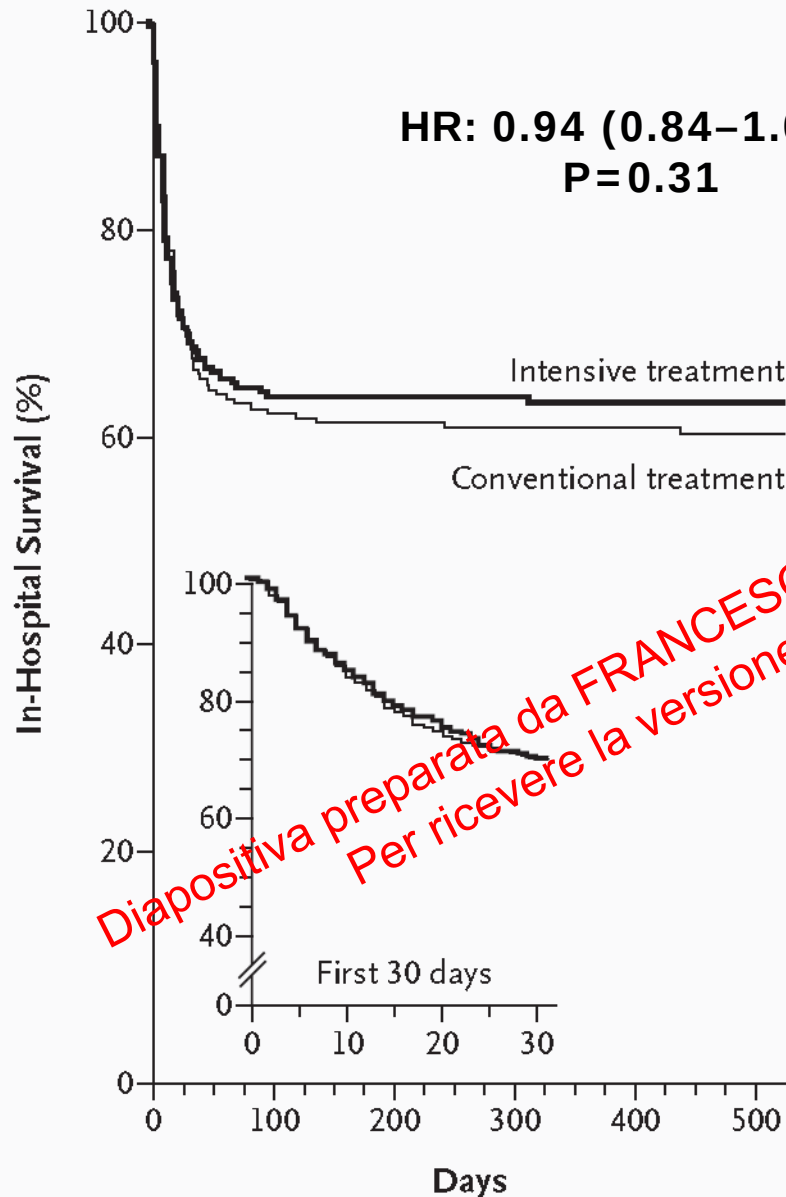
Morning blood glucose: 153 ± 33 vs. 103 ± 19 mg/dl for conventional and intensive treatment $P < 0.001$



Intensive insulin therapy in the medical ICU

Intention-to-Treat Group (N=1200)

**HR: 0.94 (0.84–1.06);
P=0.31**

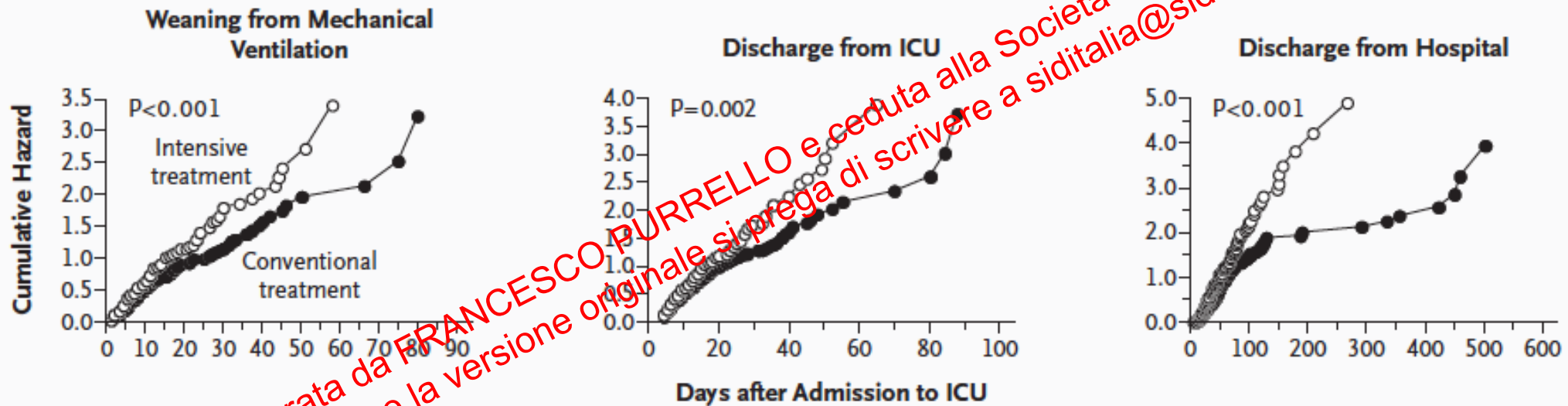


No. of Patients

Conventional-treatment group	605	538	450	381	323	286	251	226	208	188	174
Intensive-treatment group	595	536	455	386	335	290	251	217	197	175	157

Intensive insulin therapy in the medical ICU

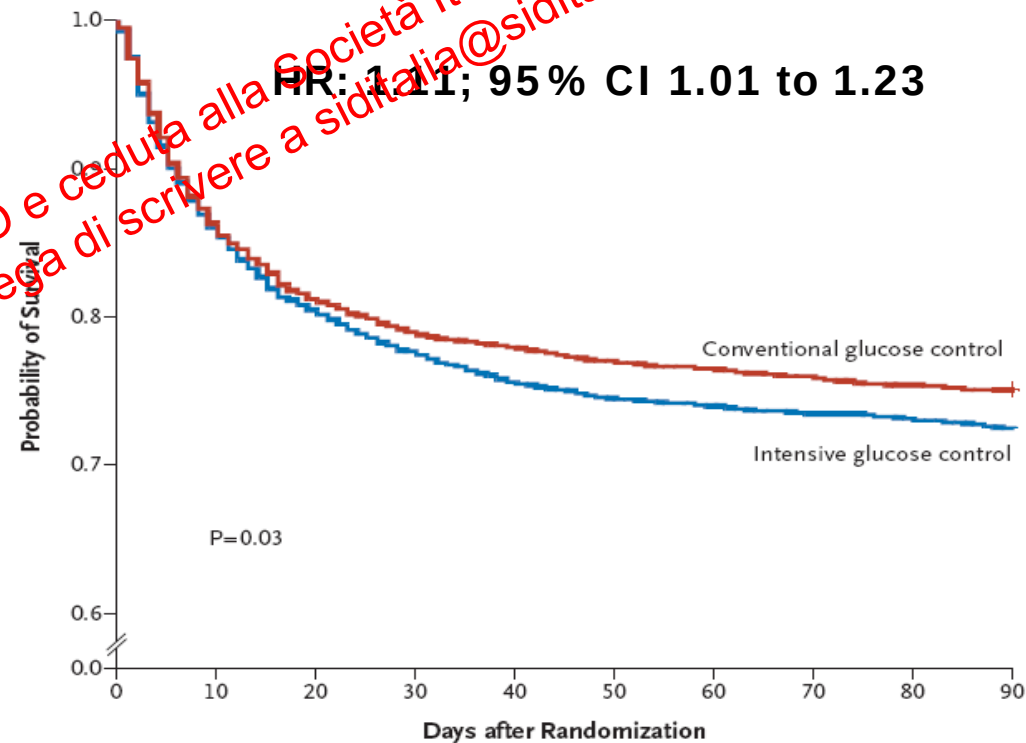
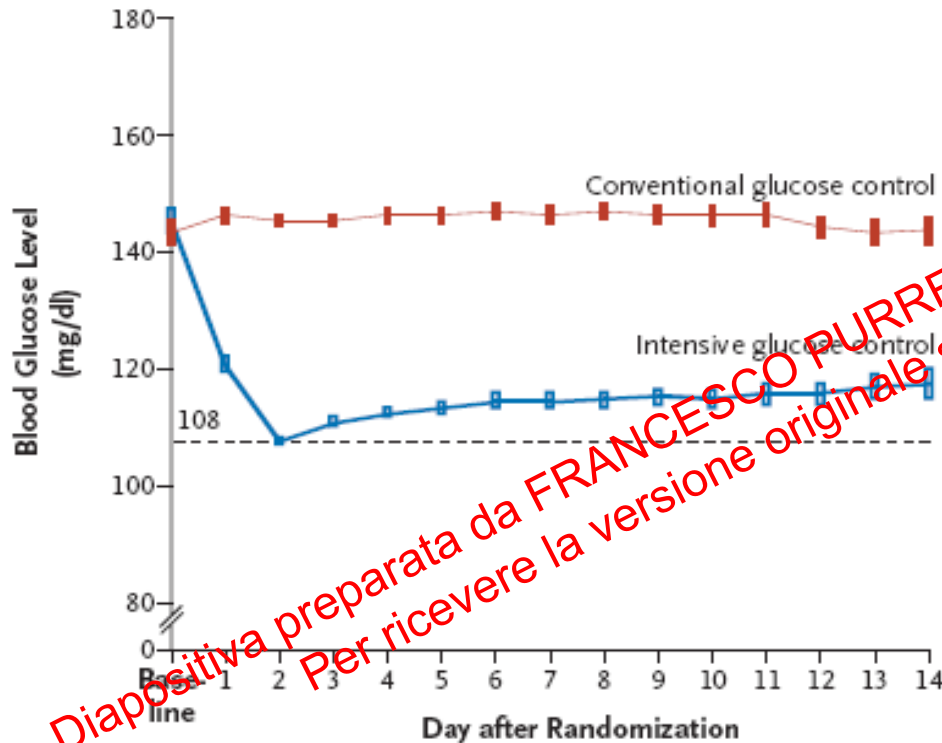
B



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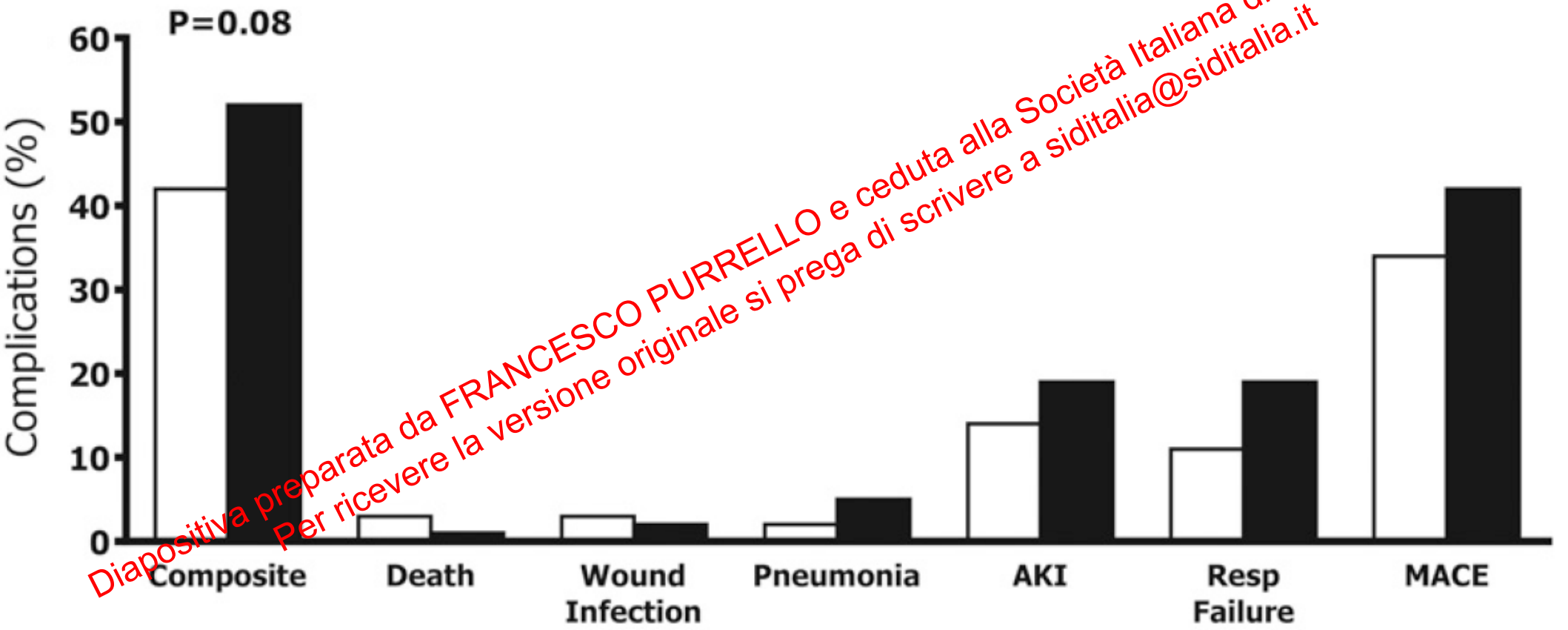
Intensive versus Conventional Glucose Control in Critically Ill Patients

The NICE-SUGAR Study Investigators*



Randomized controlled trial of intensive versus conservative glucose control in patients undergoing coronary artery bypass graft surgery: GLUCOCABG Trial

Cardiac surgery patients with hyperglycemia were randomized to intensive (100–140 mg/dL) or conservative (141–180 mg/dL) glucose targets.



The primary outcome was differences in a composite of hospital complications, including mortality, wound infection, pneumonia, bacteremia, respiratory failure, acute kidney injury, and MACE.

Cura del diabete in ospedale

Gli obiettivi glicemici

Gli obiettivi glicemici durante un ricovero ospedaliero possono essere differenziati in funzione delle diverse situazioni cliniche:

- Pazienti in situazione critica, ricoverati in Terapia Intensiva, medica o chirurgica: valori glicemici 140-180 mg/dl, in funzione del rischio stimato di ipoglicemia.

(Livello della prova II, Forza della raccomandazione B)

- Pazienti in situazione non critica: valori glicemici preprandiali <140 mg/dl, postprandiali <180 mg/dl o valori random <180 mg, se ottenibili senza rischi elevati di ipoglicemia. Target più stringenti possono essere perseguiti in soggetti clinicamente stabili e in precedente controllo glicemico ottimale. Target meno stringenti possono essere accettati in presenza di severe comorbidità.

(Livello della prova VI, Forza della raccomandazione B)

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Cura del diabete in ospedale

Il trattamento

La terapia insulinica per via sottocutanea deve seguire uno schema programmato che preveda l'uso di insulina basale. Questo schema deve essere integrato da un algoritmo di correzione basato sulla glicemia al momento dell'iniezione. Il metodo di praticare insulina solamente "al bisogno" (*sliding scale*) deve essere abbandonato.

(Livello della prova IV, Forza della raccomandazione B)

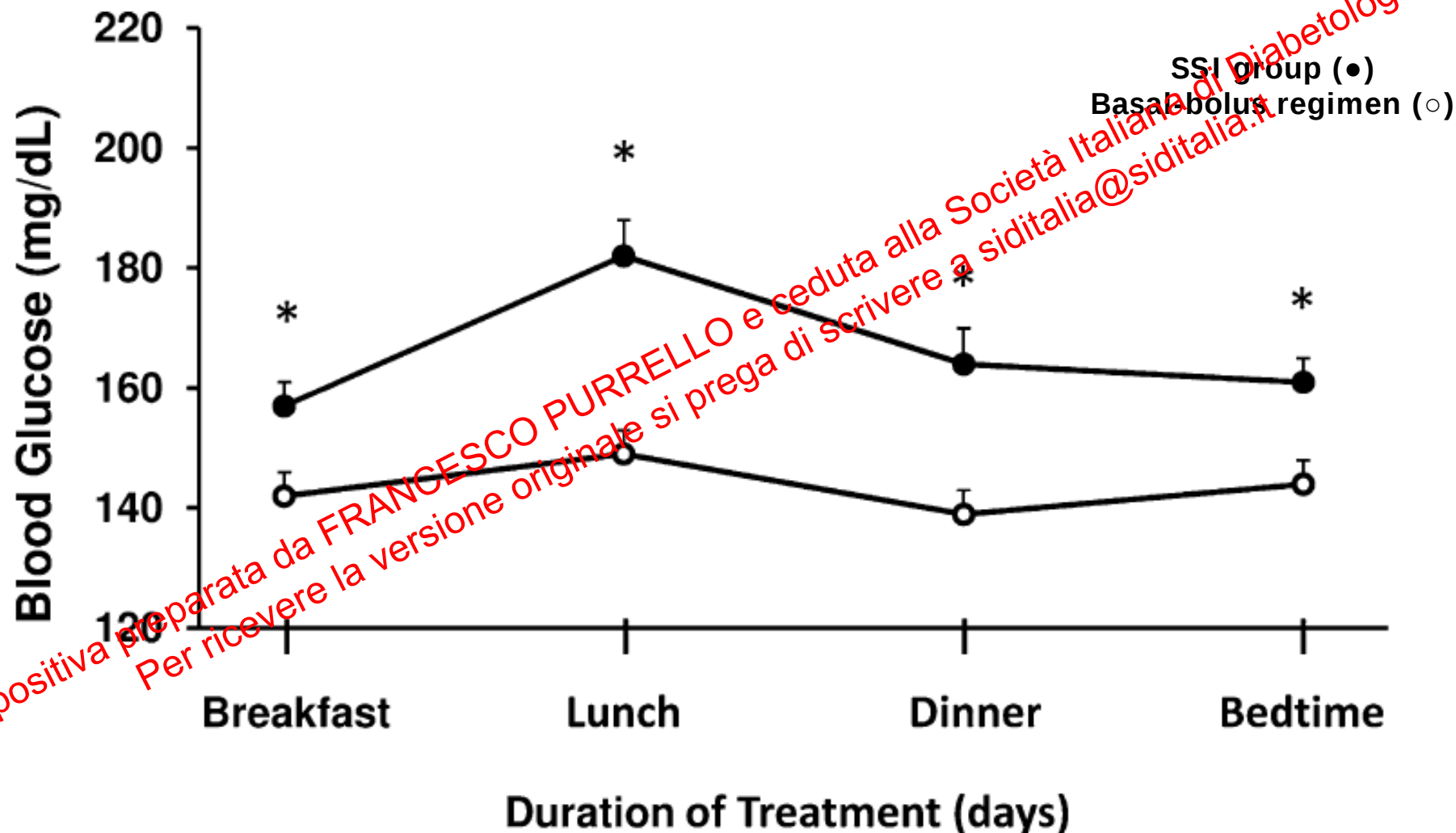
In tutti i pazienti non noti come diabetici sottoposti a trattamenti che comportano un rischio elevato di iperglicemia (corticosteroidi ad alte dosi, nutrizione enterale o parenterale, farmaci come octreotide o immunosoppressori) deve essere praticato il monitoraggio glicemico, prevedendo l'eventuale somministrazione di dosi correttive di insulina. In caso di iperglicemia persistente, si può rendere necessaria l'impostazione di una terapia insulinica basal-bolus, con gli stessi obiettivi glicemici utilizzati nei pazienti con diabete noto.

(Livello della prova VI, Forza della raccomandazione B)

Ripartizione del fabbisogno insulinico nell'arco della giornata

- Lo schema di terapia insulinica raccomandato è quello basal-bolus perché più di ogni altro mima la secrezione insulinica fisiologica.
- **Del fabbisogno insulinico giornaliero calcolato somministrare:**
 - il 40-50 % come basale;
 - il restante 50-60 % come boli prandiali suddivisi in parti uguali ai 3 pasti principali (o il 20-40-40 % rispettivamente a colazione, pranzo e cena).
- Se l'introito nutrizionale viene interrotto o marcatamente ridotto la quota insulinica prandiale/nutrizionale deve essere ridotta in modo proporzionale.
- L'uso di insuline premiscelate non è consigliabile data la poca flessibilità nel dosaggio delle stesse.

Randomized study of basal-bolus insulin therapy vs. sliding scale regular insulin four times daily in the inpatient management of patients with T2DM undergoing general surgery (RABBIT 2 Surgery)

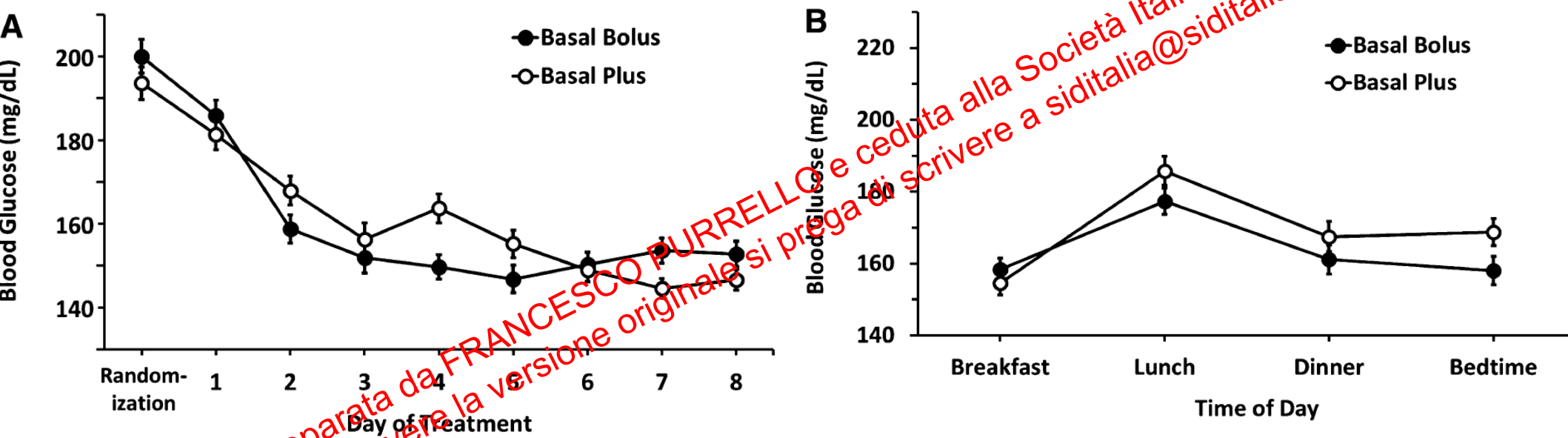


Randomized study of basal-bolus insulin therapy vs. sliding scale regular insulin four times daily in the inpatient management of patients with T2DM undergoing general surgery (RABBIT 2 Surgery)

Composite hospital complications and outcomes composite hospital complications

	All	SSI	Basal-bolus insulin	P value
Wound infections	14	11	3	0.050
Pneumonia	3	3	0	0.247
Acute respiratory failure	6	5	1	0.213
Acute renal failure	15	11	4	0.106
Bacteremia	3	2	1	0.999
Number of patients with complications	35	26	9	0.003
Mortality	2	1	1	NS
Postsurgery ICU admission (%)	16	19.6	12.5	NS
Length of stay (days)				
ICU	2.51 ± 1.90	3.19 ± 2.14	1.23 ± 0.60	0.003
Hospital	6.8 ± 8.9	6.3 ± 5.6	7.23 ± 11.39	NS

Randomized study comparing a basal-bolus with a basal plus correction insulin regimen for the hospital management of medical and surgical patients with T2DM



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Randomized study comparing a basal-bolus with a basal plus correction insulin regimen for the hospital management of medical and surgical patients with T2DM

	Basal-bolus	Basal plus	SSI	P value*
Glycemic control				<i>P=0.04 vs. SSI</i>
HbA _{1c} (%)	8.7 ± 2.5	8.3 ± 2.3	8.0 ± 2.1	0.09
Admission BG (mg/dL)	210 ± 89	207 ± 83	185 ± 72	0.12
Randomization BG (mg/dL)	200 ± 49	194 ± 45	187 ± 43	0.13
Mean BG after first day of therapy	156 ± 36	163 ± 37	172 ± 41	0.046
Daily insulin				
Total insulin (units/day)	32.2 ± 16	27.5 ± 11	8.2 ± 5	<0.001
Total insulin (units/kg/day)	0.34 ± 0.2	0.29 ± 0.1	0.1 ± 0.1	<0.001
Total glargine insulin (units/day)	21.1 ± 9	22.1 ± 8	8.2 ± 5	0.21
Total glulisine insulin (units/day)	17.1 ± 9	9.3 ± 6	—	<0.001
Hypoglycemic events				
BG tests per patient during study period	14.8 ± 11	14.3 ± 10	11.4 ± 9	0.044
Patients at <70 mg/dL	23 (16)	17 (13)	2 (3)	0.009
BG readings <70 mg/dL (%)	1.7 ± 5.3	1.1 ± 3.7	0.4 ± 2.2	0.019
Patients at <60 mg/dL	12 (8)	7 (5)	1 (1)	0.11
BG readings <60 mg/dL (%)	0.7 ± 3.4	0.4 ± 1.7	0.2 ± 1.5	0.12
Patients at <40 mg/dL	1 (1)	1 (1)	0 (0)	0.76

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Cura del diabete in ospedale

Il trattamento

L'utilizzo dei principali farmaci ipoglicemizzanti orali o iniettivi diversi dall'insulina (secretagoghi, biguanidi, tiazolidinedioni, incretine, gliflozine) presenta notevoli limitazioni in caso di patologie acute e pertanto il loro uso va considerato attentamente durante il ricovero ospedaliero ed è in genere controindicato o inopportuno nel paziente critico. La somministrazione di insulina è pertanto la terapia di scelta nel paziente diabetico ospedalizzato non stabilizzato.

(Livello della prova VI, Forza della raccomandazione B)

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Noninsulin therapies in the hospital

- Although the use of noninsulin antihyperglycemic agents are not recommended for the management of hyperglycemia in hospitalized patients, oral agents can be continued in stable patients with normal nutritional intake, normal blood glucose levels, and stable renal and cardiac function.
- However, there are several potential disadvantages to using these medications in hospital patients:

1. Disadvantages of metformin:

- Lactic acidosis can occur when used in the setting of renal dysfunction, circulatory compromise, or hypoxemia
- GI complications: Nausea, diarrhea
- procedure requiring the use of iodinated contrast material.

2. Disadvantages of sulfonylureas and meglitinides:

- Hypoglycemia if caloric intake is reduced
- Some are long-acting (hypoglycemia may be prolonged).

Noninsulin therapies in the hospital

3. Disadvantages of pioglitazone:

- Slow onset of action (2-3 weeks)
- Can cause fluid retention (particularly when used with insulin) and increase risk for CHF.

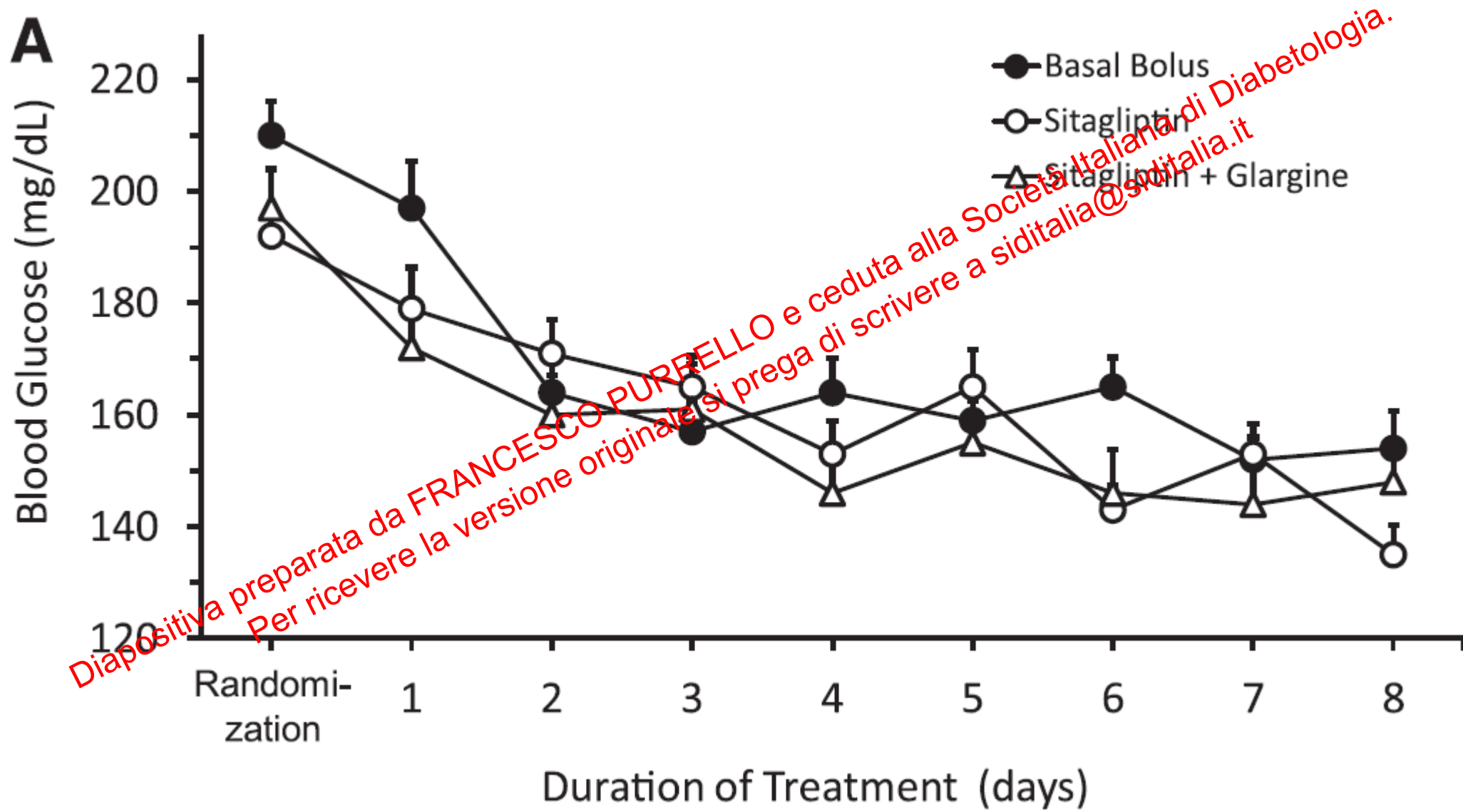
4. Disadvantages of GLP-1 mimetics

- Newer agents without data to support use in the hospital
- Abdominal bloating and nausea secondary to delayed gastric emptying
- Decrease in dietary intake.

5. Disadvantages of the sodium–glucose transporter 2 (SGLT2) inhibitors

- Ketosis
- Genital infections
- Dehydration.

Safety and efficacy of sitagliptin therapy for the inpatient management of general medicine and surgery patients with T2DM



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Safety and efficacy of sitagliptin therapy for the inpatient management of general medicine and surgery patients with T2DM

	Sitagliptin	Sitagliptin + glargine	Basal bolus	P value
Glycemic control				
HbA _{1c} (%)	7.8 ± 2.2	8.4 ± 2.1	8.4 ± 2.1	0.51
Admission BG (mg/dL)	209.4 ± 67	203.0 ± 48	227.9 ± 74	0.57
Randomization BG (mg/dL)	193 ± 44	197 ± 44	211 ± 56	0.36
BG, after 1st day of therapy	168.4 ± 35	154.2 ± 29	158.3 ± 31	0.23
Insulin/day				
Total insulin (units/day)	11.5 ± 7	28.2 ± 12	39.8 ± 22	<0.001*
Total glargine insulin (units/day)	—	20.2 ± 9	17.4 ± 9	0.12
Total lispro insulin (units/day)	11.5 ± 7	7.9 ± 6	22.4 ± 15	<0.001*
Hypoglycemic events				
Patients <70 mg/dL, n (%)	1 (4)	2 (7)	2 (8)	0.86
BG readings <70 mg/dL (%)	0.1 ± 0.6	0.7 ± 2.9	0.9 ± 3.9	0.59
Patients <60 mg/dL, n (%)	0 (0)	2 (7)	0 (0)	NA
BG readings <60 mg/dL (%)	—	0.7 ± 2.9	—	0.20
Patients <40 mg/dL, n (%)	0 (0)	0 (0)	0 (0)	NA
BG readings <40 mg/dL (%)	—	—	—	—

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