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Stefan Bornstein and colleagues<sup>1</sup> seem to be the first to react to an unprecedented challenge regarding management of diabetes in patients with COVID-19 by offering practical recommendations. The authors state that patients with diabetes have an increased risk of severe COVID-19 complications, including acute respiratory distress syndrome.

Because the practical recommendations also state that ACE2 has been identified as the receptor for the spike protein of severe acute respiratory syndrome coronavirus 2, Bornstein and colleagues discuss whether medications that increase ACE2 expression (ACE inhibitors and angiotensin II receptor blockers)<sup>2</sup> should be continued or discontinued for patients with COVID-19.

Bornstein and colleagues also mention that chronic hyperglycaemia downregulates ACE2 expression. However, the results of clinical observations are controversial; patients with diabetes have shown higher circulating ACE2 activities,<sup>3</sup> yet ACE2 expression, according to renal biopsy data in patients with type 2 diabetes and kidney disease is low.<sup>4</sup> Differences in results might be due to drug effects. Of note, clinical and experimental data indicate that diabetes is protective against the development of acute respiratory distress syndrome.<sup>5</sup> Thus, the recommended therapeutic aims for patients with diabetes and COVID-19 (plasma glucose concentration of 4–8 mmol/L and HbA<sub>1c</sub> <53 mmol/mol [7%])<sup>1</sup> might end up being too strict. In addition, the recommendations do not mention glucose-lowering drugs as a possible specific influence on the expression of ACE2 and progression of COVID-19, which is currently a topic of discussion. Preliminary answers to most questions regarding diabetes and COVID-19 cannot be obtained earlier than the results of the first observational epidemiological studies, which should be the basis for clinical recommendations.

I declare no competing interests.

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- 1 Bornstein SR, Rubino F, Khunti K, et al. Practical recommendations for the management of diabetes in patients with COVID-19. *Lancet Diabetes Endocrinol* 2020; **8**: 546–50.
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### Authors' reply

We are pleased to learn about the interest in our paper on the practical recommendations for the management of diabetes in patients with COVID-19.<sup>1</sup> These Correspondences address important aspects regarding the use of medications and the risk of hypoglycaemia or obesity, and we are thankful for these comments.

Jagat Mukherjee and colleagues suggest considering the role of sulfonylureas and PPAR- $\gamma$  agonists in patients with diabetes and COVID-19 disease. They elaborate on a potential protective role of pioglitazone by three hypothetical mechanisms, including ACE2 regulation, inhibition of a protease in severe acute respiratory syndrome coronavirus 2 replication, and the drug's well-known anti-inflammatory effect. Although we restricted the list of anti-diabetes drugs to the most commonly used agents in modern diabetes management, several other glycaemia-modulating drugs, including pioglitazone, are discussed in a review by Ciavarella and colleagues.<sup>2</sup> Jean-Daniel Lalau and Abdallah Al-Salameh comment on the role of metformin, emphasising its antifibrotic, anti-inflammatory, and

cell-protective effects. Furthermore, they mention a possible antimicrobial feature of metformin. Given these beneficial effects, they recommend maintaining metformin in hospitalised patients with COVID-19 who have not yet developed kidney or liver failure. Although Mukherjee and colleagues and Jean-Daniel Lalau and Abdallah Al-Salameh raise interesting points, we believe questions related to the role of metformin and pioglitazone on virus entry and effects on cell integrity and function will be better addressed in mechanistic studies on a cellular or subcellular level. To date, insulin must remain the first-choice agent in the management of critically ill hospitalised patients.

Medha Munshi and Sarah Sy discuss the glycaemic goals for older patients with diabetes and COVID-19 disease and suggest that older patients with functional and cognitive decline, as well as those living in long-term facilities, will require a different set of guidelines. We agree with the comment that hypoglycaemia is a critical risk factor, especially in the elderly, and treatment goals have to be adjusted to individual patient situations, considering comorbidities and the environmental conditions during the pandemic. We attempted to cover many levels of health care in many countries with different health-care systems and economies. Therefore, the recommendations should be read as a general line of action that must be adapted accordingly.

Adrian Li and colleagues emphasise that a disproportionately high frequency of acute diabetes-related complications, such as ketoacidosis, often with concurrent hyperosmolality, occur at the initial presentation of patients with or without pre-existing diabetes. We agree with this important note and stress the need for careful review of potential associations with mediating medications as well as investigating direct virus-related effects. Initial diagnostic routine should identify acute diabetes-related