

Use Of Mobile-enabled Reminders Feature Is Associated With Improved Behavioral And Glycemic Outcomes In The Real World



Ricardo Abad, MS, Tong Sheng, PhD, Sarine Babikian, PhD, Michael Greenfield, MD

INTRODUCTION

In the real-world, lifestyle and environmental barriers can adversely impact self-management of diabetes. Emerging health technologies such as mobile diabetes management apps can potentially help people with diabetes navigate such barriers with features such as reminders for self-monitoring blood glucose (SMBG) checks and medications. While such features are designed to help people with diabetes improve the structure and adherence of SMBG and medication regimens, real-world evidence of their effectiveness have been inconclusive. In the current study, we assess whether the use of reminders features corresponded with improved behavioral and glycemic outcomes in the real world.

METHODS

We randomly sampled behavioral and SMBG data from the Glooko data warehouse (Glooko, Inc, Mountain View, CA, www.glooko.com). A random sample of 500 users of the Glooko® mobile app who had used the app to set reminders were included in the analyses. We compared the distributions of SMBG check rates, mean blood glucose (BG) levels, and the proportions of low (<70 mg/dL), in-range (between 70-180 mg/dL), and high BG readings (>250 mg/dL) before and after users had set up reminders within the app.

Table 1: Sample information. Self-reported demographic information of randomly sampled Glooko® mobile app users.

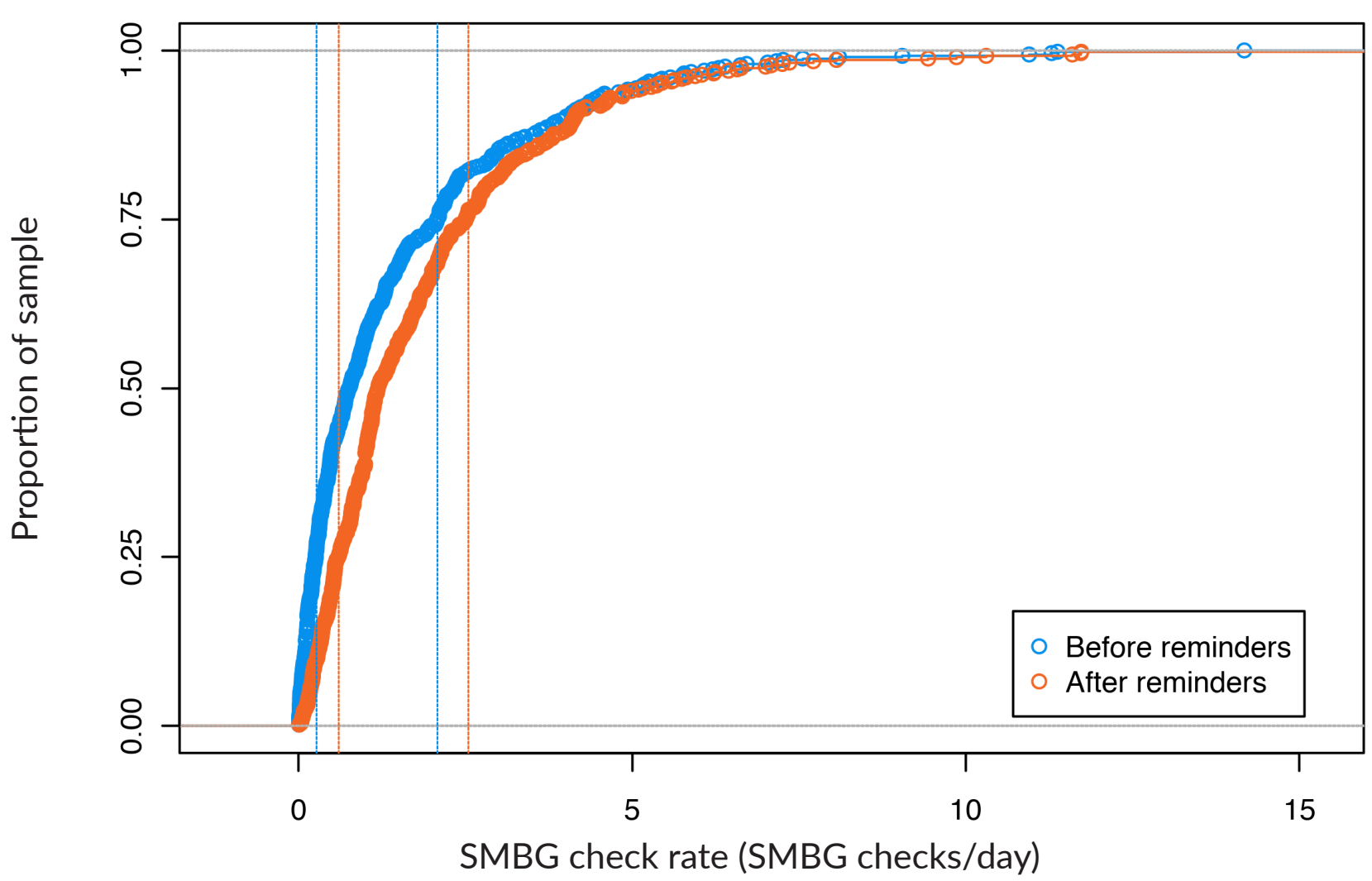
Age	Median:	46 years
	IQR:	36-56 years
Gender	Female:	38.2%
	Male:	61.8%
Diabetes Type	Type 1:	25%
	Type 2:	69%
	Other:	6%

RESULTS

Among users with self-reported demographic information, 38.2% were female, median age was 46 years (IQR: 36-56), 25% had type 1 diabetes, 69% had type 2 diabetes, and 6% had some other type of diabetes (Table 1). Two-sample Kolmogorov-Smirnov tests showed that, after setting reminders, users performed more frequent SMBG checks ($D=.21$, $P<.001$; Figure 1). Users also had lower mean BG ($D=.11$, $P=.0059$), more in-range readings ($D=.088$, $P=.042$), and fewer high readings ($D=.12$, $P=.0024$) after setting reminders (Figures 2-5). No difference in the distributions of low readings was observed before and after setting reminders ($D=.072$, $P=.15$; Figure 3). Empirical cumulative distribution functions (ECDFs) for each of these outcomes before and after setting reminders are shown in Figures 1-5.

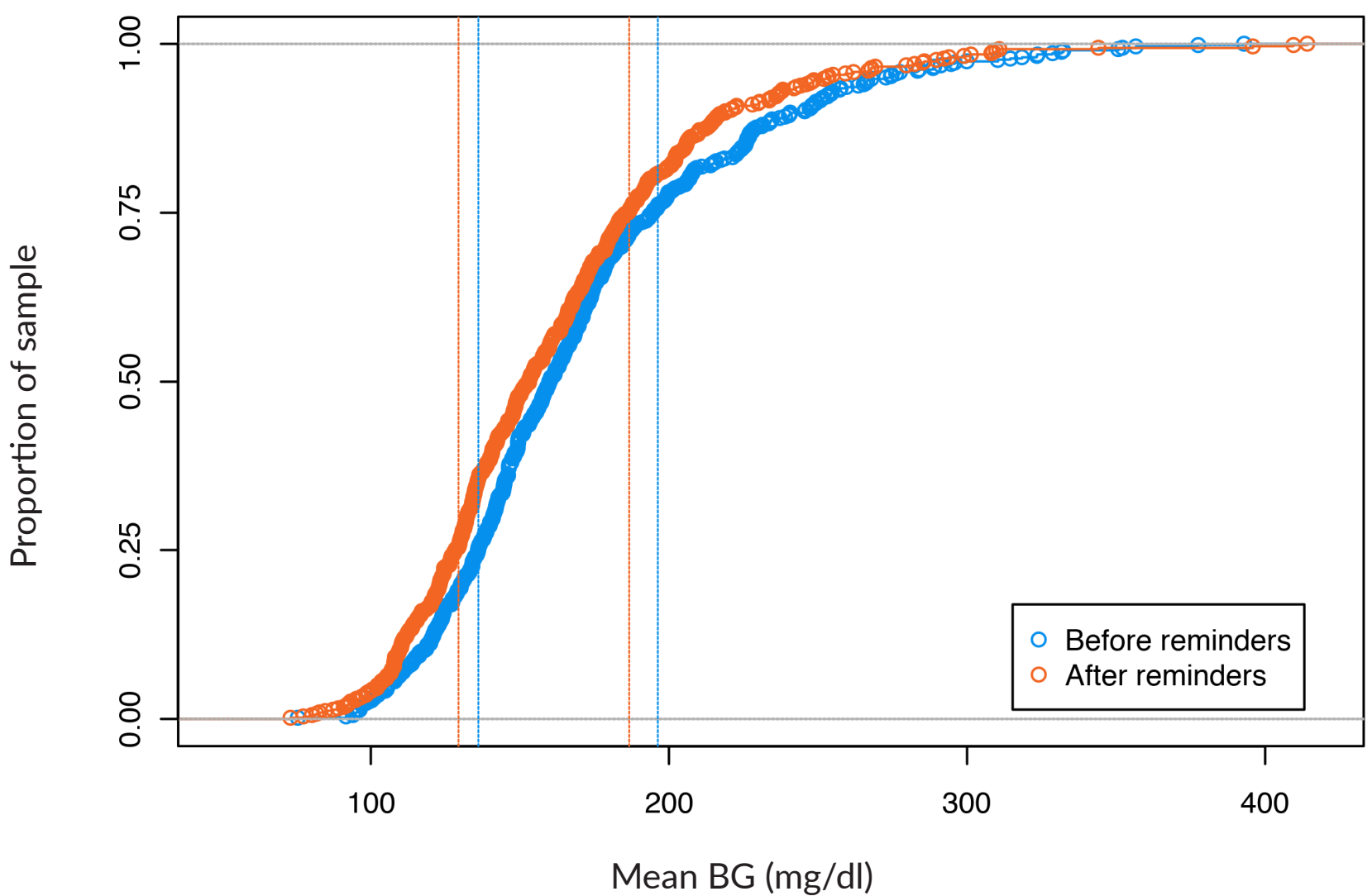
SMBG check rate before/after setting reminders

Figure 1: SMBG check rate before and after setting reminders. The ECDF after reminders is shifted right (i.e., more checks/day) relative to the ECDF before reminders.



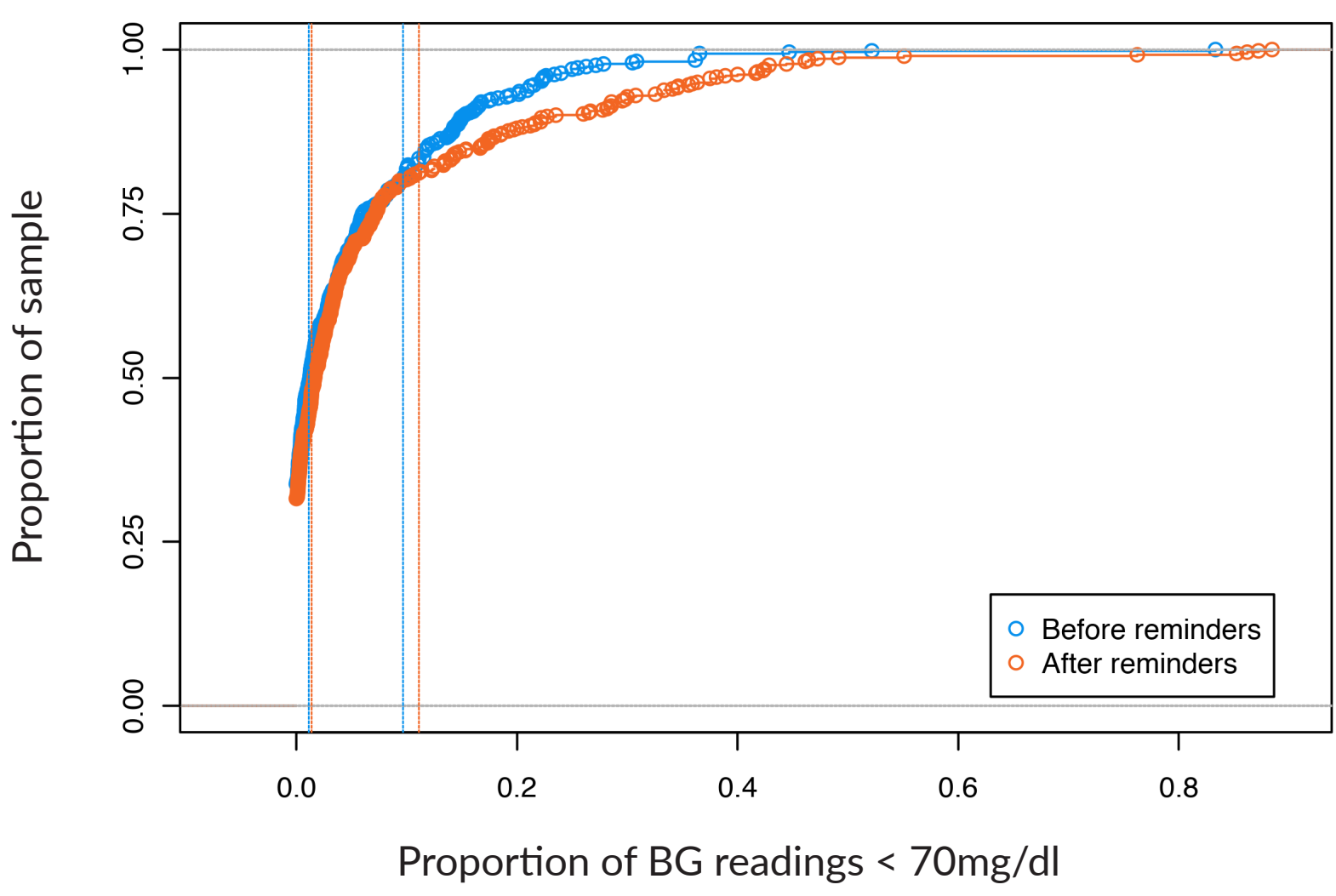
Mean BG before/after setting reminders

Figure 2: Mean BG before and after setting reminders. The ECDF after reminders is shifted left (i.e., lower mean BG) relative to the ECDF before reminders.



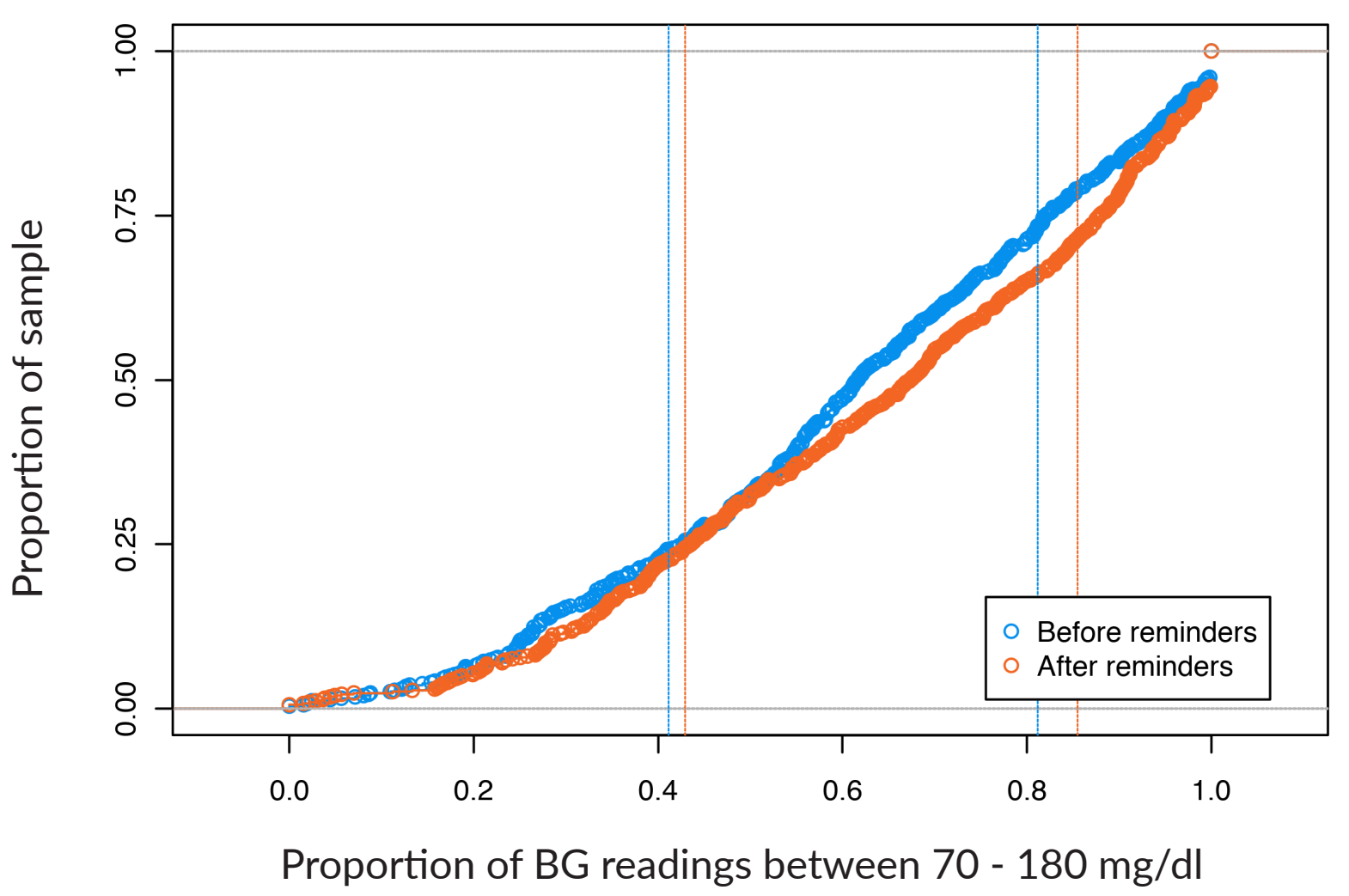
Proportion of hypoglycemic BG readings before/after setting reminders

Figure 3: Proportion of hypoglycemic (< 70 mg/dl) SMBG readings before and after setting reminders. Overall, the ECDF after reminders is not significantly different relative to the ECDF before reminders, despite some visible disparity between the ECDFs.



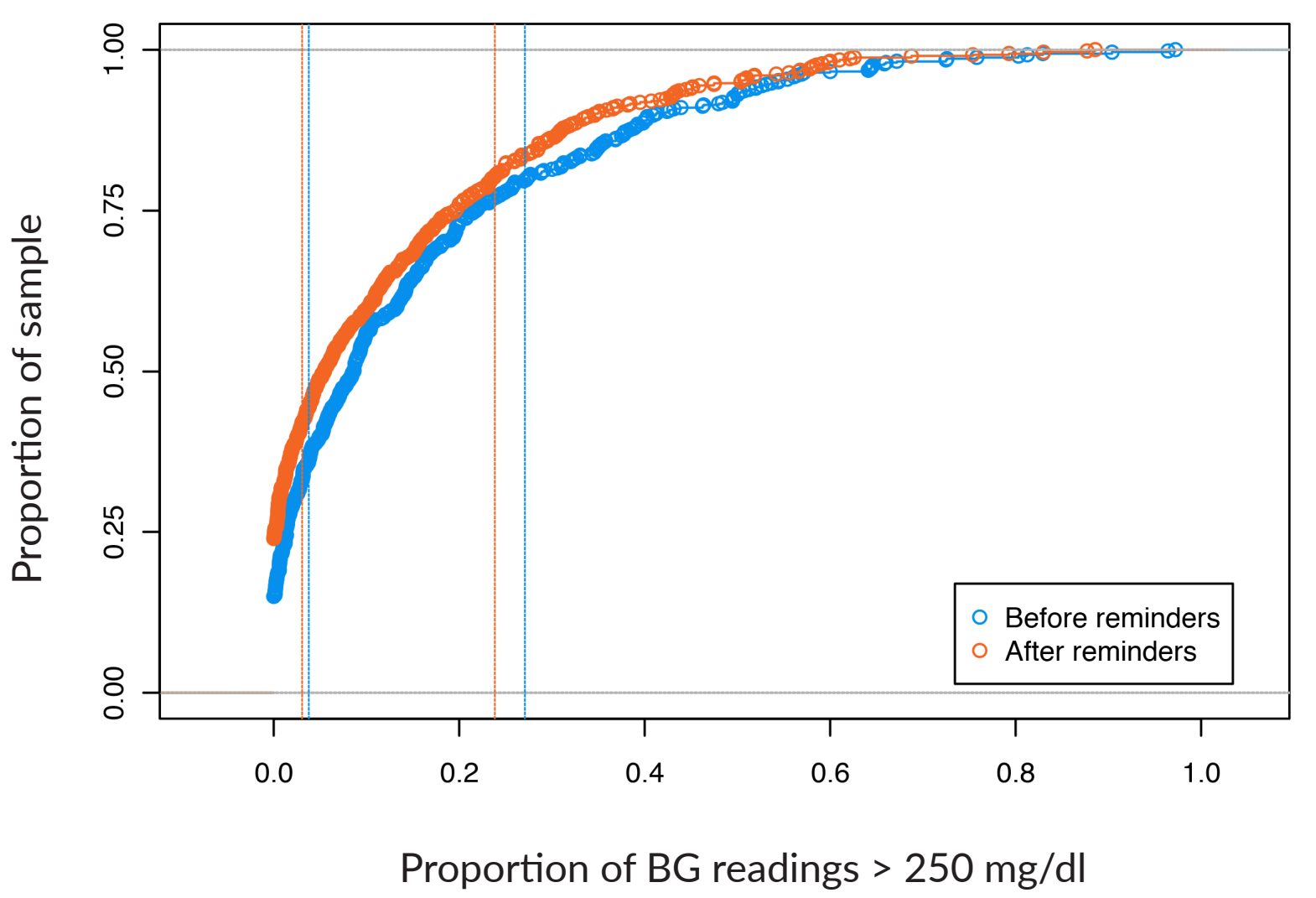
Proportion of in-range BG readings before/after setting reminders

Figure 4: Proportion of in-range (70 - 180 mg/dl) SMBG readings before and after setting reminders. Overall, the ECDF after reminders is shifted right (i.e., greater proportion of readings in-range) relative to the ECDF before reminders.



Proportion of hyperglycemic BG readings before/after setting reminders

Figure 5: Proportion of hyperglycemic (> 250 mg/dl) SMBG readings before and after setting reminders. Overall, the ECDF after reminders is shifted left (i.e., smaller proportion of hyperglycemic readings) relative to the ECDF before reminders.



DISCUSSION

Taken together, these findings indicate that mobile-enabled reminders can contribute to improved SMBG behavior and glycemic outcomes in the real world. As expected, users performed more frequent SMBG checks and experienced improved glycemic outcomes after setting reminders. As with many real-world studies, some limitations exist in ensuring data consistency and the broad range of baseline characteristics. Nonetheless, these findings provide a preliminary (and somewhat conservative) view of the potential benefits of using mobile health tools. As mobile health/digital therapeutic tools (and their ever-growing features/capabilities) continue to evolve, patients and clinicians have reason for optimism that such tools can improve diabetes management and reduce burden.