

## Use of Automated Bolus Advisors May Improve Adherence to Multiple Daily Insulin Injection Therapy

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**A**utomated bolus advisors provide the capability to automatically calculate bolus insulin dosages to cover carbohydrate intake and address out-of-range blood glucose levels, and they have been shown to be safe and effective in reducing postprandial glucose excursions and improving overall glycemic control.<sup>1</sup> Although insulin pump users have had access to bolus advisors since 2008, this technology is now available to patients with diabetes who are treated with multiple daily insulin injections (MDI). These hand-held devices incorporate a bolus advisor into a blood glucose meter, enabling users to obtain prandial and correction bolus recommendations based on their current blood glucose value, planned carbohydrate intake, and individualized therapy parameters stored in the device. A key benefit of this technology is its potential to improve patients' adherence to their MDI regimens. Because manual calculation of insulin boluses is complex and time-consuming, patients might rely on empirical estimates, which may result in hypoglycemia, hyperglycemia, and weight gain.<sup>2</sup> Other factors, such as fear of hypoglycemia and low numeracy, can also adversely impact treatment adherence.

Fear of hypoglycemia is often a key obstacle to starting insulin, intensifying therapy, and/or adhering to prescribed insulin regimens.<sup>3</sup> Baseline data from a large randomized trial of 212 MDI-treated patients showed that fear of hypoglycemia was common; 82 participants reported that they "often" or "almost always" reduced their insulin as an avoidance strategy.<sup>4</sup> Another obstacle is poor numeracy, which can lead to errors in interpreting blood glucose results to determine correction doses and inaccuracies in calculating insulin doses based on insulin to carbohydrate ratios, all of which were correlated with poor glycemic control.<sup>5</sup>

Use of bolus advisors can potentially address these issues. In a survey of 588 MDI-treated patients who used a bolus advisor for a minimum of 4 weeks, more than half of respondents indicated that their fear of hypoglycemia was "reduced" (39.0%) or "significantly reduced" (13.0%).<sup>6</sup> The majority of respondents also reported improvements in confidence and greater ease in calculating insulin dosages. These results suggest that use of an automated bolus advisor may alleviate some of the fears and difficulties associated with MDI therapy. A large randomized multicenter trial—Automated Bolus Advisor Control and Usability Study (ABACUS)—is underway to determine if use of an automated bolus advisor can in fact improve clinical and psychosocial outcomes in people treated with MDI. The results of this study will be available in late 2012.

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**Abbreviations:** (MDI) multiple dose insulin injections

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Technology alone is not a solution for good clinical care; health care providers should also utilize available tools to assess patients' attitudes regarding their fear of hypoglycemia and competencies in numeracy. A list of validated assessment tools for emotional barriers is presented in **Table 1**. Health care providers should be aware of the challenges to daily diabetes self-management, actively pursue strategies to identify and address these obstacles through ongoing assessment of and attention to patients' emotional status and MDI-related skills, and utilize available technologies, such as automated bolus advisors, to help patients optimize their insulin therapy and improve their clinical outcomes and quality of life.

**Table 1.**  
**Validated Tools for Assessing Emotional Barriers and Skills Deficits**

Instrument	Description	Scoring
Patient Health Questionnaire 8 (PHQ8)	Self-report measure of depression.	Each of 8 items scores from 0 = 'not at all' to 3 = 'nearly every day'  Major depressive disorder (PHQ8): ≤ 4: no significant symptoms; 5–9: mild symptoms; 10–14: moderate symptoms; 15–19: moderately severe symptoms; and ≥ 20: severe symptoms.
Problem Area in Diabetes (PAID)	Covers a range of emotional states frequently reported in diabetes. It is primarily a measure of diabetes-specific emotional distress.	Each of 20 items scores from 0 = 'not a problem' to 4 = 'serious problem'  PAID summary score: 0–39: no distress; 40–59: mild distress; 60–79: moderate distress; and 80–100: severe distress.
Hypoglycemia Fear Scale (HFSII)	Provides an assessment of an individual's fear of hypoglycemia both overall and in terms of behavior and worry.  Used to assess both fear of hypos and maladaptive behaviors to avoid them.	Each of 33 items scores from 0 = 'never' to 4 = 'always'  Score for frequency/severity of avoidance behavior: 0–36: no/ slight avoidance behavior; 37–48: moderate avoidance behavior; and 49–60: frequent/ severe avoidance behavior.  Score for severity of worry: 0–43: no/ slight worry; 44–57: moderate worry; and 57–72: frequent/ severe worry.

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