

## RESEARCH

# Effect of an Experiential Exercise in Diabetes Management on Pharmacy Students' Fear and Perceived Pain of Injection and Fingertip Lancing

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**Objective.** To determine if a diabetes management exercise would change pharmacy students' fear and perceived pain associated with injection and fingertip lancing.

**Methods.** Before and after a 1-week experiential exercise of living with diabetes, students completed questionnaires measuring fear of injection and self-testing and recorded the level of perceived pain associated with injection and fingertip lancing. Anticipated (baseline) and experienced (follow-up) scores were compared.

**Results.** Forty students returned both baseline and follow-up survey instruments. Reported levels of fear decreased significantly for self-injection ( $p < 0.0001$ ) and self-testing ( $p = 0.0089$ ) after the exercise. Experienced pain was also significantly lower than anticipated pain for both injection ( $p < 0.0001$ ) and fingertip lancing ( $p = 0.013$ ). Experienced pain of injection was significantly lower than fingertip lancing ( $p = 0.017$ ).

**Conclusion.** Participation in the exercise significantly reduced pharmacy students' fear and perceived pain associated with injection and fingertip lancing. Students can use information gained from their experiences when helping patients manage diabetes.

**Keywords:** Experiential education, diabetes, pharmacy students

## INTRODUCTION

Almost 1 in 10 people in the world have diabetes, a chronic disease with significant implications on individuals and our health care system.<sup>1</sup> To help manage the elevated blood glucose levels associated with diabetes, most clinical practice guidelines recommend routine monitoring, an activity that requires fingertip lancing to obtain a small droplet of blood.<sup>2,3</sup> In addition, all patients with type 1 diabetes and some patients with type 2 diabetes require daily insulin injections. Although both activities can help control blood glucose and reduce the risk of diabetes-related complications,<sup>4-6</sup> few patients follow the recommendations for self-monitoring of blood glucose.<sup>7</sup>

A common patient-level barrier to self-monitoring of blood glucose and injecting insulin is the fear of pain associated with injection and with fingertip lancing.<sup>8,9</sup> Several studies have examined patient fear of injecting and self-testing.<sup>8,10,11</sup> However, little is known about the health care provider's feelings towards these activities. Indeed, it is important to know how health care providers

feel about injection and self-testing because their opinions may influence how advice is provided to patients.<sup>12</sup> It is also beneficial to determine if misconceptions about the fear and pain of injection and of fingertip lancing could be changed.

In 2011, Diamond and Matok reported it was possible to change pharmacists' perceptions of the pain associated with insulin pen injections and fingertip lancing with a group teaching session.<sup>13</sup> We wanted to know if an experiential educational exercise would help change student attitudes towards these activities. We hypothesized that participation in a 1-week experiential exercise about diabetes would reduce student fear and perceived pain associated with injection and fingertip lancing.

## METHODS

The Faculty of Pharmacy and Pharmaceutical Sciences Pharmacy, University of Alberta provides a 4-year program leading to a bachelor's of science degree in pharmacy, which is the entry-to-practice degree in Alberta, Canada. In the third year of this program, students are asked to complete a diabetes homework assignment as part of a course covering disorders of the endocrine organs. The goal of this homework exercise is to give students an opportunity to experience feelings people with diabetes face every day when managing this disease. At

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the beginning of the exercise, students are “diagnosed” with type 2 diabetes and told they must carefully manage their blood glucose over the next week. Two major components of the exercise are self-monitoring of blood glucose and administration of mock insulin injections. Students are instructed to check their blood glucose twice daily using a lancing device and standard blood glucose meter. They are also instructed to use an empty insulin pen to administer mock injections twice daily.

A structured small-group training session is used to educate students on the proper techniques for self-monitoring of blood glucose and administering mock insulin injections. Pharmacists who have active diabetes practices lead these sessions and the content is consistent with current guideline recommendations and training material provided to patients who are starting insulin.<sup>3,14,15</sup> The session runs for 50 minutes with a ratio of 8 students to 1 pharmacist in each session. Students are encouraged to attempt at least one blood glucose check and mock insulin injection while they are directly supervised by the pharmacists.

We evaluated the effect of this program on students’ fears and perceived pain of injection and self-testing during the 2013 offering of this homework exercise. The University of Alberta Health Research Ethics Board approved the conduct of this study and all students who participated provided written informed consent.

Students were asked to complete a baseline survey and return it at the beginning of the training session for the experiential exercise. The follow-up survey was administered at the end of the 1-week exercise. Both surveys contained the Diabetes Fear of Injecting and Self-Testing Questionnaire (D-FISQ) developed by Snoek and colleagues and a pair of 100 mm visual analogue scales.<sup>8,10</sup> In addition to the D-FISQ and visual analogue scales, we collected information on respondent age and sex, number of blood glucose checks and mock insulin injections administered during the week, and a unique identification code to help match baseline and follow-up surveys for each participant.

The D-FISQ contains 2 subscales to measure a respondent’s fear of self-injecting and fear of self-testing separately.<sup>8,10</sup> Each item is presented as a statement with responses ranging from 0, almost never, to 3, almost always. The fear of self-injecting subscale has 8 statements and the summary score can range from 0 to 24. The fear of self-testing subscale has 9 statements and the summary score can range from 0 to 27. This questionnaire is considered a reliable and valid instrument for evaluating fear of needles and lancets in people with diabetes.<sup>8,10,11</sup>

Two horizontal 100 mm visual analogue scales were used in each survey to measure perceived pain associated

with fingertip lancing and mock insulin injections. Both visual analogue scales were anchored with “no pain” and “worst imaginable pain.” Respondents were asked to draw a vertical line at the point on this line that best represents the level of their anticipated (baseline) and experienced (follow-up) pain. Values from these scales are the distance between the left anchor (“no pain”) and the respondent’s mark, measured in millimeters.

Our primary hypothesis was that participation in the experiential exercise would reduce student fear and perceived pain associated with fingertip lancing and injection. To test this hypothesis, we compared anticipated (baseline) and experienced (follow-up) scores using the Kruskal-Wallis rank test. Because we had 4 separate outcome measures (fear of self-testing, fear of self-injection, perceived pain of fingertip lancing, and perceived pain of injection) to evaluate the effect of the experiential exercise, we used the Bonferroni adjustment for multiple testing and adjusted the alpha level for significance to  $p < 0.013$  for our primary analyses.

In a secondary analysis, we were interested in determining if student opinions at the end of the exercise were different for fingertip lancing compared to injecting. To examine students’ fear of these activities, follow-up scores for the self-testing and self-injection subscales of the D-FISQ were compared using the Kruskal-Wallis rank test. Experienced (follow-up) pain scores from the visual analogue scales for fingertip lancing and injection were also compared using the Kruskal-Wallis rank test. For both comparisons, a  $p < 0.05$  was considered significant.

We chose to use nonparametric statistics to test our comparisons because responses to the D-FISQ and visual analogue scales were not normally distributed. All analyses were conducted using Stata 13 (StataCorp LP, College Station, TX).

## RESULTS

Of the 125 students enrolled in the third year of our program, 85 (68%) returned the baseline survey and 52 (42%) returned the follow-up survey. From the returned surveys, we were able to identify 40 matched pairs of baseline and follow-up surveys. Our main analyses were conducted using the information provided by these 40 students. A sensitivity analysis, using information from all returned surveys, was similar in direction, magnitude, and significance (reported in Appendix 1).

Mean age of the 40 students with matched baseline and follow-up surveys was 24 ( $\pm 2$ ) years, and 78% were women. These characteristics were similar to the remaining 85 students and therefore our sample was reasonably representative of the third year class. Twenty-seven (68%) students reported checking their blood glucose at

least once daily during the experiential exercise. However, only 13 (33%) administered a mock injection at least once daily during the same time period.

Baseline scores for the fear of self-injection and self-testing were similar (Table 1). By the end of the 1-week exercise, students reported significantly lower levels of fear. Moreover, over half of the respondents reported a fear of self-injection score  $\leq 2$  and a fear of self-testing score  $\leq 1$ , suggesting students had low levels of fear of these activities after the experiential exercise was completed.

Prior to the start of the experiential exercise, students reported that they anticipated the insulin injection would be slightly more painful than fingertip lancing (Table 1). After the exercise, experienced pain was significantly lower for both injection and fingertip lancing. In addition, students reported the pain from an injection was significantly lower than the pain from fingertip lancing.

## DISCUSSION

Most people with diabetes are asked to perform painful activities such as lancing their finger to check blood glucose levels or self-administering insulin injections to help manage elevated blood glucose levels associated with this chronic disease. Health care professionals are responsible for helping these patients learn proper techniques and incorporate these activities into their daily routines. Although we have evidence-based guideline recommendations to help support many of these educational activities, clinician opinions may also influence the advice we provide.<sup>2,3,12,16</sup> For example, clinicians often believe that fear of injections are a critical barrier to introducing insulin in patients with type 2 diabetes and, therefore, may delay introducing this therapeutic alternative.<sup>12,16</sup> However, patients appear to rate other concerns, like addiction to insulin, the complexity of insulin regimens, and perceived restrictions on lifestyle, as more important compared to the fear of injection pain.<sup>12,16</sup> It would seem, therefore, that educating health care professionals

about the perceived level of pain associated with injection may reduce some, but not all, barriers to the introduction of insulin in patients with type 2 diabetes.

Diamond and Matok demonstrated that participation in an educational session significantly reduced perceived pain of injection and fingertip lancing.<sup>13</sup> In their study, pharmacists were asked to report the perceived level of pain using a 100 mm visual analogue scale. Observations from our study are consistent with those from Diamond and Matok, whereby baseline perceptions of pain were significantly higher than the reported levels of experienced pain. In addition, both groups thought the insulin pen injection would be more painful than fingertip lancing before the educational sessions; however, after experiencing both an injection and fingertip lancing, pharmacists and pharmacy students reported the latter was significantly more painful. Our study builds on the observations from Diamond and Matok by illustrating that student fear of injection and self-testing also decreased significantly after the experiential exercise.

The pain of injection and fingertip lancing our students experienced is an important teaching tool to prepare them for situations in which patients are considering the addition of insulin to their diabetes management strategy. Patients, much like the students at the start of the exercise, may perceive that a needle will be more painful than the fingertip lancing. However, after participating in this exercise, students would be able to tell patients about the difference in pain they personally experienced between the fingertip lancet and insulin pen needle.

Observations from our study should be interpreted in light of its limitations. First and foremost, this was an uncontrolled, before-and-after design. Although this was an acceptable, pragmatic method for evaluating effect of the experiential exercise, a control group would have strengthened the causal inference. Second, prior student experience with insulin injections and fingertip lancing could have affected baseline measures of fear and perceived pain

Table 1. Reported Levels of Fear and Perceived Pain Before and After a 1-Week Experiential Exercise in Diabetes Management (40 Students with Paired Baseline and Follow-up Surveys)

|  | Baseline   | Follow-up | Difference* |
|--|------------|-----------|-------------|
| Fear of Self-Injection <sup>†</sup>              | 8 (5-12)   | 2 (0-7)   | <0.0001     |
| Fear of Self-Testing <sup>†</sup>                | 7 (1-12)   | 1 (0-8)   | 0.0089      |
| Between-Scale Difference*                        | 0.20       | 0.53      |             |
| Perceived Pain of Injection <sup>‡</sup>         | 30 (21-50) | 8 (2-13)  | <0.0001     |
| Perceived Pain of Fingertip Lancing <sup>‡</sup> | 23 (11-35) | 14 (6-26) | 0.013       |
| Between-Scale Difference*                        | 0.11       | 0.017     |             |

Values are reported as median (interquartile range)

\* Groups compared using Kruskal-Wallis rank test

<sup>†</sup> Measured using the Diabetes Fear of Injection and Self-Testing Questionnaire<sup>8,10</sup>

<sup>‡</sup> Measured using a 100 mm visual analogue scale

and decreased effect of the experiential exercise. Third, our study shared the limitation noted by Diamond and Matok in their study, in that we asked students to use an empty insulin pen for the mock injections. The added pressure required to depress the plunger into an insulin cartridge could increase the pain experienced by patients. Fourth, our sample size was relatively small, with only 40 students providing both baseline and follow-up surveys. However, we were able to observe significant reductions in all 4 outcome variables (fear of self-injection, fear of self-testing, perceived pain of injection, and perceived pain of fingertip lancing) even after adjusting our threshold of significance for multiple tests.

## CONCLUSION

We observed that participation in an experiential exercise significantly reduced pharmacy students' fear and perceived pain of injection and fingertip lancing. Students can use information gained from their experiences when helping patients manage diabetes.

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## REFERENCES

1. Danaei G, Finucane MM, Lu Y, et al. National, regional, and global trends in fasting plasma glucose and diabetes prevalence since 1980: systematic analysis of health examination surveys and epidemiological studies with 370 country-years and 2.7 million participants. *Lancet*. 2011;378(9785):31-40.

2. American Diabetes Association. Standards of medical care in diabetes—2014. *Diabetes Care*. 2014;37(Suppl 1):S14-80.
3. Berard L, Blumer I, Houlden R, Miller D, Woo V. Monitoring glycemic control. *Can J Diabetes*. 2013;37:S35-S9.
4. Polonsky WH, Fisher L, Schikman CH, et al. Structured self-monitoring of blood glucose significantly reduces A1C levels in poorly controlled, noninsulin-treated type 2 diabetes: results from the Structured Testing Program study. *Diabetes Care*. 2011;34(2):262-267.
5. The Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *N Engl J Med*. 1993;329:977-986.
6. UK Prospective Diabetes Study Group. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). *Lancet*. 1998;352(9131):837-853.
7. Polonsky WH, Fisher L, Hessler D, Edelman SV. A survey of blood glucose monitoring in patients with type 2 diabetes: are recommendations from health care professionals being followed? *Curr Med Res Opin*. 2011;27(Suppl 3):31-37.
8. Snoek F, Mollema E, Heine R, Bouter L, van der Ploeg H. Development and validation of the diabetes fear of injecting and self-testing questionnaire (D-FISQ): First findings. *Diabet Med*. 1997;14(10):871-876.
9. Polonsky W, Fisher L, Guzman S, Villa-Caballero L, Edelman S. Psychological insulin resistance in patients with type 2 diabetes: The scope of the problem. *Diabetes Care*. 2005;28(10):2543-2545.
10. Mollema ED, Snoek FJ, Pouwer F, Heine RJ, van der Ploeg HM. Diabetes Fear of Injecting and Self-Testing Questionnaire: a psychometric evaluation. *Diabetes Care*. 2000;23(6):765-769.
11. Simmons JH, McFann KK, Brown AC, et al. Reliability of the Diabetes Fear of Injecting and Self-Testing Questionnaire in pediatric patients with type 1 diabetes. *Diabetes Care*. 2007;30(4):987-988.
12. Nakar S, Yitzhaki G, Rosenberg R, Vinker S. Transition to insulin in type 2 diabetes: family physicians' misconception of patients' fears contributes to existing barriers. *J Diabetes Complications*. 2007;21(4):220-226.
13. Diamond S, Matok I. Pharmacists' anticipated pain compared to experienced pain associated with insulin pen injection and fingertip lancing. *Can J Diabetes*. 2011;35(3):282-286.
14. McGibbon A, Richardson C, Hernandez C, Dornan J. Pharmacotherapy in type 1 diabetes. *Can J Diabetes*. 2013;37(Suppl 1):S61-S60.
15. Harper W, Clement M, Goldenberg R, et al. Pharmacologic management of type 2 diabetes. *Can J Diabetes*. 2013;37:S61-S8.
16. Polonsky W, Hajos T, Dain M, P., Snoek F. Are patients with type 2 diabetes reluctant to start insulin therapy? An examination of the scope and underpinnings of psychological insulin resistance in a large, international population. *Curr Med Res Opin*. 2011;27(6):1169-1174.

Appendix 1. Reported Levels of Fear and Perceived Pain Before and After a 1-Week Experiential Exercise in Diabetes Management (Information from all Baseline and Follow-up Surveys)

|  | <b>Baseline (n=85)</b> | <b>Follow-up (n=52)</b> | <b>Difference*</b> |
|--|------------------------|-------------------------|--------------------|
| Fear of Self-Injection <sup>†</sup>              | 11 (7-14)              | 4 (0-9)                 | <0.0001            |
| Fear of Self-Testing <sup>†</sup>                | 9 (3-14)               | 2 (0-8)                 | <0.0001            |
| Between-Scale Difference*                        | 0.18                   | 0.17                    |                    |
| Perceived Pain of Injection <sup>‡</sup>         | 31 (22-52)             | 10 (3-21)               | <0.0001            |
| Perceived Pain of Fingertip Lancing <sup>‡</sup> | 20 (10-39)             | 16 (7-26)               | 0.067              |
| Between-Scale Difference*                        | 0.0008                 | 0.041                   |                    |

Values are reported as median (interquartile range)

\* Groups compared using Kruskal-Wallis rank test

<sup>†</sup> Measured using the Diabetes Fear of Injection and Self-Testing Questionnaire<sup>8,10</sup>

<sup>‡</sup> Measured using a 100 mm visual analogue scale