Predictors of Prescriber Preference for Expensive Insulins: A Single Institution Survey

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Abstract

Background: The average cost of insulin has increased greatly recently, partly due to prescription of newer expensive insulins. This has caused insulin underuse among economically vulnerable uninsured patients. Herein, predictors of preference for expensive (higher retail price) insulins among primary care physicians are investigated.

Methods: Internal medicine and family medicine attending physicians and residents at West Suburban Medical Center (Oak Park, Illinois, USA) participated in a web-based survey (Qualtrics Survey Platform) via email between October 20, 2020, and November 10, 2020. Baseline characteristics, prescribing preferences (Insulins Ranks, lower rank indicates higher preference), factors determining insulin choice, pricing knowledge, dosing knowledge, and training were recorded. Insulins were classified as "Inexpensive" (retail price ≤ median insulin price) or "Expensive." The mean rank of expensive and inexpensive insulins prescribed were calculated. Participants were divided into either the "Inexpensive Prescription Preferences" (IPP; mean rank of Inexpensive insulins ≤ mean rank of Expensive insulins) or "Expensive Prescription Preferences" (EPP) groups. Groups were compared. Multivariable logistic regression assessed predictors of IPP.

Results: The response rate was 78% (72/92). Among the 70 participants included, EPP (n = 43) and IPP participants (IPP, n = 27) had similar baseline characteristics (Physician Role, Specialty, and Practice Type), except EPP physicians graduated earlier ($P = 0.011$). EPP participants reported prescribing insulin glargine more often ($P = 0.018$) and also ranked it higher ($P < 0.001$). Logistic regression identified that previous Endocrine rotations ($P = 0.031$) and senior Physician Role ($P = 0.001$) predicted EPP.

Conclusion: Previous endocrinology rotations, and senior role predict prescription of insulins with a high retail price. Speculatively, training physicians in cheaper prescription practices may lower costs. Further studies are required to generalize these results.

Key Words: diabetes mellitus, insulin price, preference, surveys and questionnaires

Abbreviations: EPP, Expensive Prescription Preferences; IPP, Inexpensive Prescription Preferences.

The average cost of insulin has increased greatly over recent years. Between 2002 and 2013 insulin expenditure nearly tripled [1], while out-of-pocket expenses doubled in the United States [2, 3]. High insulin costs have resulted in insulin underuse. In the 2020 T1International survey, which included individuals with type 1 diabetes mellitus, ~25% of respondents from the United States reported insulin underuse due to perceived costs [3]. To address this issue, the American Diabetes Association (ADA) Insulin Access and Affordability Working Group recommended: "providers should be trained to appropriately prescribe all forms of insulin preparations" [4]. Furthermore, "providers should prescribe the lowest-priced insulin required to effectively and safely achieve treatment goals." Summarily, a lack of training, knowledge, or experience in the use of older insulin may shift prescriber preferences toward more expensive types.

Herein, we investigate factors that drive preference for more expensive (ie, higher retail price) insulins among physicians at the institution level through a web-based survey.

Materials and Methods

Internal medicine and family medicine attending physicians and residents at West Suburban Medical Center (Oak Park, Illinois, USA) were invited to participate in a web-based survey (Qualtrics Survey Platform) via email between October 20, 2020, and November 10, 2020. Table 1 details the survey design. Data regarding participant baseline characteristics, prescribing preferences (insulins with lower rank indicate higher preference), factors determining insulin choice, pricing knowledge, dosing knowledge, and training were recorded. Insulins were classified as "Inexpensive" (retail price ≤ median insulin price) or "Expensive" using published data on average retail prices (Table 2) [5]. Participants were divided into either the "Inexpensive Prescription Preferences" (mean rank of Inexpensive insulins ≤ mean rank of Expensive insulins) or "Expensive Prescription Preferences" groups. Group characteristics were compared (Tables 3 and 4).

Categorical variables were described as frequencies (%) and compared using the Chi-squared test. Continuous variables

were described as median (interquartile range) and compared using the Mann–Whitney test. A multivariable logistic regression model was used to assess predictors of Inexpensive Prescription Preferences. IBM SPSS statistics (version 26) was used for all statistical analyses.

Table 1. Survey questions

Survey question	Type	Options
What is your current role?	Multiple Choice, Single Answer	1. PGY1 2. PGY2 3. PGY3 4. Attending Physician
What is your date of graduation?	Rank	Select from Calendar
What type of practice do you have?	Multiple Choice, Single Answer	1. Inpatient 2. Outpatient 3. Mixed
Which Specialty of residency are you in or have you completed?	Multiple Choice, Single Answer	1. Internal Medicine 2. Family Medicine
Have you done a rotation under an Endocrinologist?	Multiple Choice, Single Answer	Yes/No
Kindly select the insulins that you prescribe	Multiple Choice, Multiple Selections	List of Insulins[a]
Kindly rank the preference of use of insulin	Drag-and-Drop	List of Insulins[a]
What is the main factor that affects your choice of insulin?	Multiple Choice, Single Answer	1. Comfort of use for the prescriber—ie, used a specific type for years/training 2. Insurance hassle and need for prior authorization 3. Cost Restriction 4. Patient Preference or Other
Kindly select the most expensive insulin as per your opinion.[b]	Multiple Choice, Single Answer	List of Insulins[a]
Kindly select the most inexpensive insulin as per your opinion.[b]	Multiple Choice, Single Answer	List of Insulins[a]
Are you familiar with dosing mixed insulins like Novolin 70-30?	Multiple Choice, Single Answer	1. Yes 2. No
Have you been trained to prescribe and use mixed insulins?	Multiple Choice, Single Answer	1. Yes 2. No
What kind of dosing is primarily used for Novolin 70-30?	Multiple Choice, Single Answer	1. Once Daily 2. Twice Daily 3. Three Times Daily 4. Unsure or Unanswered

[a]Lispro (Humalog®), Regular insulin (Novolin R, Humulin R), NPH insulin (Novolin N, Humulin N), 50% insulin Lispro Protamine and 50% insulin Lispro (Humalog® mix 50/50), Glulisine (Apidra®), Glargine (Lantus®, Basaglar® Toujeo®), Detemir (Levemir®), 70% insulin Aspart Protamine and 30% insulin Aspart (NovoLog® mix 70/30), Digludec (Tresiba), Aspart (Novolog®), 75% NPL and 25% insulin lispro (Humalog® mix 75/25), Other.
[b]"Most Expensive" insulins were in the upper quartile of insulin prices, while "Most Inexpensive" insulins were in the lower quartile.

Results

Definitions for Insulin Pricing

The median insulin price was $0.3375/Unit. Insulins priced ≤ $0.3375/Unit were "Inexpensive" (n = 7), while insulins priced > $0.3375/Unit were considered "Expensive" (n = 6). Insulins priced in the top quartile were considered "Most Expensive," while those in the lower quartile were considered "Most Inexpensive." The "Most Expensive" insulins were priced ≥ $0.39/Unit (n = 4), while the "Most Inexpensive" insulins were priced ≤ $0.23/Unit (n = 4). Table 2 presents details.

Overall Sample Characteristics

The response rate was 78% (72/92). After exclusion (n = 2, incomplete survey), the 70 remaining participants were included in the final analytical cohort. Median rank of inexpensive insulins was 2.75 (1.5), and expensive insulins was 2 (1). Median number of inexpensive insulins prescribed was 2.75 (1.5), and expensive insulins prescribed was 2 (1.5). Year of graduation of participants ranged from 1976 to 2025 in the whole sample. Other population characteristics are provided in Table 3.

Group Characteristics

General characteristics

Expensive Prescription Preferences participants (EPP, n = 43) and Inexpensive Prescription Preferences participants (IPP, n = 27) had similar baseline characteristics (Table 3), except EPP physicians graduated earlier (Mann–Whitney $U = 788$, $P < 0.05$) and had a more senior role (Mann–Whitney $U = 373$, $P < 0.05$).

Table 2. Insulin pricing definitions

All insulins	Average price[a]	Inexpensive/ expensive[b]	Most expensive/ most inexpensive[c]
Isophane-Regular 70-30	0.100	Inexpensive	Most Inexpensive
Regular Insulin	0.160	Inexpensive	Most Inexpensive
NPH Insulin	0.198	Inexpensive	Most Inexpensive
Aspart Protamine 70/30	0.230	Inexpensive	Most Inexpensive
Lispro-NPL 70-30	0.282	Inexpensive	—
Lispro	0.319	Inexpensive	—
Aspart	0.338	Inexpensive	—
Lispro-NPL 75-25	0.347	Expensive	—
Glargine	0.375	Expensive	—
Detemir	0.390	Expensive	Most Expensive
Glulisine	0.420	Expensive	Most Expensive
Lispro Protamine 50/50	0.430	Expensive	Most Expensive
Digludec	0.530	Expensive	Most Expensive

[a]Average insulin prices based on data published by GoodRx [3].
[b]"Inexpensive" insulins had a retail price ≤ median insulin price ($0.3375/ Unit). The rest were "Expensive."
[c]"Most Expensive" insulins were in the upper quartile of insulin prices, while "Most Inexpensive" insulins were in the lower quartile.

Table 3. Characteristics of expensive and inexpensive insulin prescription groups

Variable	Inexpensive prescription group, n = 27 (% or IQR)	Expensive prescription group, n = 43 (% or IQR)	P value
Physician role	2 (2)	3 (2)	**Mann–Whitney $U = 373$, $P = 0.010$***
PGY1	11 (40.7%)	6 (14%)	
PGY2	8 (29.6%)	9 (20.9%)	
PGY3	2 (7.4%)	13 (30.2%)	
Attending	6 (22.2%)	15 (34.9%)	
Specialty			χ^2 (1, N = 70) = 0.349, $P = 0.554$
Internal Medicine	17 (63%)	24 (55.8%)	
Family Medicine	10 (10%)	19 (44.2%)	
Year of graduation	2022 (2)	2021 (3)	**Mann–Whitney $U = 788$, $P = 0.011$***
PGY1	2023 (0)	2023 (2.5)	
PGY2	2022 (0)	2022 (0)	
PGY3	2021 (0)	2021 (0)	
Attending	2019 (8.5)	2018 (7)	
Practice type			χ^2 (2, N = 70) = 0.362, $P = 0.835$
Inpatient	6 (22.1%)	10 (23.3%)	
Mixed	20 (74.1%)	30 (69.8%)	
Outpatient	1 (3.7%)	3 (7%)	
Knowledge of insulin pricing			
Most expensive insulin correctly identified[a]	19/29	29/44	χ^2 (1, N = 69) = 0.001, $P = 0.982$
Most inexpensive insulin correctly identified[a]	14/29	25/44	χ^2 (1, N = 69) = 0.936, $P = 0.333$
Knowledge of mixed insulin dosing			
Previous Endocrinology rotation	12/30	15/44	χ^2 (1, N = 70) = 0.148, $P = 0.701$
Familiar with mixed insulin dosing	16/30	27/44	χ^2 (1, N = 70) = 1.020, $P = 0.313$
Received training for mixed insulin	9/30	21/44	χ^2 (1, N = 70) = 2.966, $P = 0.085$
Dosing question correct	12/30	24/44	χ^2 (1, N = 70) = 0.341 $P = 0.126$
Prescribing habits per prescriber			
Number of inexpensive insulins prescribed	2 (2)	3 (2)	Mann–Whitney $U = 502$, $P = 0.331$
Mean rank of inexpensive insulins prescribed	2.5 (1.5)	3 (1.5)	**Mann–Whitney $U = 301.5$, $P = 0.001$[†]**
Number of expensive insulins prescribed	2 (1)	2 (1)	Mann–Whitney $U = 567$, $P = 0.866$
Mean rank of expensive insulins prescribed	2.75 (1.5)	2 (1.5)	**Mann–Whitney $U = 837$, $P < 0.001$[‡]**
Main factor determining insulin choice			χ^2 (3, N = 70) = 1.892, $P = 0.595$
Comfort of use for the prescriber	18	23	
Insurance hassle, need for preauthorization	3	6	
Cost restriction	6	11	
Patient preference or other	3	4	

[a]Most Expensive Insulins: average retail price ≥ top quartile of insulin prices; Most Inexpensive Insulins: average retail price ≤ bottom quartile of insulin prices.
*$P < 0.05$, [†]$P < 0.01$, [‡]$P < 0.001$.

Experience and knowledge of insulin dosing and pricing

The distribution of participants who were familiar with mixed insulin dosing, correctly answered the dosing question, received mixed insulin training, and had a previous endocrinology rotation were similar between IPP and EPP groups (all $P > 0.05$). The Most Expensive insulin was correctly identified at similar rates in the IPP and EPP groups (65.52% vs 65.91% in IPP vs EPP participants, $P > 0.05$). See Table 3.

Insulin preferences

The mean rank of Inexpensive Insulins prescribed, and mean rank of Expensive Insulins prescribed was lower in the IPP (Mann–Whitney U, $P = 0.004$) and EPP (Mann–Whitney U, $P = 0.002$) groups, respectively. However, the number of inexpensive and expensive insulins prescribed were not significantly different between the groups (Table 3).

A significantly higher number of respondents in the EPP group reported prescribing insulin glargine (χ^2 [1, N = 70] = 5.549, $P < 0.05$) compared to those in the IPP group. Also, when ranking insulins in order of preference, participants in the EPP group placed insulin glargine (Mann–Whitney $U = 770$, $P < 0.01$) and lispro (Mann–Whitney $U = 242$, $P < 0.01$) higher up in their rank list (higher level of preference) than the IPP group (Table 4).

Most participants in both groups identified comfort of use for the prescriber as the Main Factor Determining Insulin Choice, followed by cost restriction. There was no statistically significant difference in the Main Factor Determining Insulin Choice between groups (χ^2 [3, N = 70] = 1.892, $P = 0.595$).

Table 4. Comparison of insulins prescribed and ranks between groups

	Cheap prescription group, frequency (%) or median (range)	Expensive prescription group, frequency (%) or median (range)	P value
n	27	43	
Insulins prescribed			
Lispro	26 (96.3%)	41 (95.3%)	χ^2 (1, N = 70) = 0.036, P = 0.849
Regular	11 (40.7%)	15 (34.9%)	χ^2 (1, N = 70) = 0.244, P = 0.662
NPH	5 (18.5%)	15 (34.9%)	χ^2 (1, N = 70)= 2.177, P = 0.140
50% Lispro Protamine and 50% Lispro	5 (18.5%)	3 (7.0%)	χ^2 (1, N = 70) = 2.183, P = 0.140
Glulisine	0	0	
Glargine	22 (81.5%)	42 (97.7%)	**χ^2 (1, N = 70) = 5.549, P = 0.018***
Detemir	12 (44.4%)	20 (46.5%)	χ^2 (1, N = 70) = 0.029, P = 0.886
70% Aspart Protamine 30% Aspart	12 (44.4%)	23 (53.5%)	χ^2 (1, N = 70) = 0.543, P = 0.461
Digludec	3 (11.1%)	3 (7.0%)	χ^2 (1, N = 70) = 0.362, P = 0.548
Aspart	10 (37.0%)	21 (48.8%)	χ^2 (1, N = 70) = 0.936, P = 0.333
75%NPL 25% Lispro	3 (11.1%)	5 (11.6%)	χ^2 (1, N = 70) = 0.004, P = 0.947
Other	0	0	
Insulins ranks			
Lispro	1 (1-3)	2 (1-5)	**Mann–Whitney U = 242, P < 0.001[†]**
Regular	3 (1-6)	5 (2-8)	Mann–Whitney U = 49.5, P = 0.087
NPH	3 (3-6)	5 (3-8)	Mann–Whitney U = 16.5, P = 0.066
50% Lispro Protamine and 50% Lispro	5 (4-6)	4 (2-5)	Mann–Whitney U = 11, P = 0.393
Glulisine	0	0	
Glargine	2 (1-3)	1 (1-2)	**Mann–Whitney U = 770, P < 0.001[†]**
Detemir	3 (1-5)	3 (1-6)	Mann–Whitney U = 143.5, P = 0.366
70% Aspart Protamine 30% Aspart	4 (3-7)	4 (2-6)	Mann–Whitney U = 140, P = 0.959
Digludec	7 (3-9)	4 (3-6)	Mann–Whitney U = 6.5, P = 0.400
Aspart	3 (1-4)	4 (3-6)	Mann–Whitney U = 68, P = 0.124
75%NPL 25% Lispro	5 (5-8)	5 (4-6)	Mann–Whitney U = 9, P = 0.786
Other	0	0	

*P < 0.05, †P < 0.01.

Forward stepwise logistic regression was performed to identify predictors of expensive prescription preferences (model χ^2 [3, N = 70] = 14.095, P = 0.001; Nagelkerke R^2 = 0.252). Summarily, previous endocrine rotations (B[SE] = 0.900 [0.418], OR = 2.459 [1.083-5.580], P = 0 < 0.05) and seniority of role (B[SE] = 1.145 (0.356), OR = 3.142 [1.565-6.309], P < 0.01) were significant predictors of expensive prescription preferences.

Discussion

Insulin selection has important implications on insulin affordability, especially for uninsured individuals who pay retail prices. To the best of our knowledge, this is the first study to identify factors that influence preference for insulins with a high retail price among primary care physicians. Our results suggest that previous rotations under an endocrinologist and a senior role predict preference for expensive insulins (ie, insulins priced above median). Furthermore, we identified comfort of use for the prescriber as the main factor driving insulin selection. Improving physician's comfort of use for inexpensive insulins through education may speculatively reduce prescription prices.

In 2017, ADA convened The Insulin Access and Affordability Working Group (Workgroup) to define the extent of the insulin affordability issue and develop strategies to tackle the problem. Aside from several pharmacoeconomic factors that influence insulin pricing, the Workgroup also noted that prescriptions for expensive insulin analogues have continued to increase, while cheaper conventional insulins have reduced in popularity [2, 4]. To tackle this, they recommended that providers must prescribe the lowest-price insulin required to reach treatment goals, and that providers should be trained in the use of a variety of insulins to allow for this [4].

To sway prescriber preferences toward cheaper insulins, an understanding of the factors that influence expensive prescriber preferences is required. Thus far, there is a dearth of research in this regard. We hypothesized that a lack of training, knowledge, or experience in the use of conventional insulin may shift prescriber preferences toward more expensive types.

Our results suggest the primary factor determining prescriber insulin choice was comfort of use for the prescriber, regardless of expensive or inexpensive prescribing preferences. This emphasizes the importance of training to ensure physicians are comfortable using a variety of insulins, including inexpensive insulins.

Herein, our multivariate logistic regression model identified previous training under an endocrinologist and a senior role predict preference for expensive insulins. Previous training under an endocrinologist resulted in a 71% increase in the probability of expensive prescription preferences as inferred from the odds ratio. Speculatively, rotations under an endocrinologist may increase preference for expensive insulins because more "challenging" patients might present to an endocrinologist. Therefore, more expensive insulins might be indicated to reach treatment goals. These prescribing practices may be inherited by trainees (who lack exposure to older and cheaper insulin regimens) and implemented on patients that do not require expensive insulins to reach treatment goals. Structured and targeted training on conventional insulin dosing, price sensitivity, and indications may have allayed these expensive prescription habits. Furthermore, we identified that a more senior role predicts preference for expensive insulin. Importantly, the prescription practices of senior physicians may also be inherited by their trainees. Therefore, attending physicians should also be targeted for training.

We reiterate the ADA working group's message that "providers should prescribe the lowest-priced insulin required to effectively and safely achieve treatment goals" [4]. Further research is required to determine whether targeted training can alter prescription preferences, and thereby lower prescription costs, especially for uninsured populations.

Limitations

This study was a single-center survey study with a limited sample size. Additionally, respondents who were attending physicians (22.2% of the IPP and 34.9% of the EPP groups) comprised a relative minority compared to residents. Further studies with large, nationally representative samples are required to generalize these results.

Disclosures/Conflict of Interest

All authors declare no financial support or conflict of interest.

Data Availability

Some or all datasets generated during and/or analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request.

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