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Expenditures and Prices of Antihyperglycemic Medications in the United States: 2002–2013

Xinyang Hua, MSc, **Natalie Carvalho, PhD**, **Michelle Tew, MPH**, **Elbert S. Huang, MD**, **William H. Herman, MD, MPH**, and **Philip Clarke, PhD**

School of Population and Global Health, University of Melbourne, Victoria, Australia (Hua, Carvalho, Tew, Clarke); Department of Medicine, University of Chicago, Chicago, Illinois (Huang); School of Public Health, University of Michigan, Ann Arbor (Herman)

A recent study demonstrated widespread substitution of analog for human insulin and rising out-of-pocket costs in privately insured people with type 2 diabetes in the United States.[1] Medicaid reimbursements have increased for both human insulin and more costly analog insulins.[2] Although studies have described per-person changes in excess medical spending of US adults with diabetes on prescription medications,[3] they have not reported trends in expenditures for different classes of antihyperglycemic medications that simultaneously consider changes in use and price.

Methods

We analyzed individual and prescription-level data from the Medical Expenditure Panel Survey (MEPS) to describe and compare trends in expenditure and price of antihyperglycemic medications in the United States from 2002 through 2013. The MEPS involves deidentified, publicly available data of a nationally representative household survey of noninstitutionalized residents.[4] The in-person interview response rate ranged from 69.2% to 58.0%. We first described the prevalence of treated patients with diabetes, their characteristics, and use of antihyperglycemic medications. We then estimated inflation-adjusted expenditures per patient for insulin (combining both human and analog) compared with other classes of antihyperglycemic medications. Medications were identified using Multum Lexicon therapeutic class codes. Drug expenditures from all sources (including patient co-payments) and quantity used came from household surveys, with data verified by pharmacies. Relative and absolute mean drug prices were calculated by dividing expenditure

Corresponding Author: Philip Clarke, PhD, Centre for Health Policy, School of Population and Global Health, University of Melbourne, Level 4, 207 Bouverie St, Carlton Victoria 3053, Australia (; Email: philip.clarke@unimelb.edu.au)

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Study concept and design: Tew, Herman, Clarke.

Acquisition, analysis, or interpretation of data: All authors.

Drafting of the manuscript: Hua, Carvalho, Herman, Clarke.

Critical revision of the manuscript for important intellectual content: Tew, Huang, Herman, Clarke.

Statistical analysis: Hua, Carvalho, Tew.

Administrative, technical, or material support: Tew, Huang.

Study supervision: Herman, Clarke.

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per prescription by quantity. All analyses were conducted in Stata (StataCorp), version 13.1, accounting for MEPS sampling weights and the complex survey design. The 95% confidence intervals were calculated and compared to determine statistically significant differences.

Results

The unweighted analytic sample consisted of 27 878 people treated for diabetes (mean age, 60.4 years [SD, 14.7]; men, 44.4%). During the study period, the prevalence of treated diabetes increased from 5.2% (95% CI, 4.9%–5.4%) in 2002–2004 to 7.7% (95% CI, 7.4%–8.0%) in 2011–2013 (Table). For those with recorded insulin use, the quantity per year increased from 171 mL (95% CI, 160–181) in 2002–2004 to 206 mL (95% CI, 193–220) in 2011–2013; over the same period, estimated spending for insulin per patient increased from $231.48 (95% CI, $190.40–272.55) in 2002 to $736.09 (95% CI, $639.72–$832.47) in 2013 (Figure). In 2013, estimated expenditure per patient amounted to $507.89 (95% CI, $422.34-$593.44) for analog insulin and $228.20 (95% CI, $183.98-$273.42) for human insulin. The total expenditure on insulin in 2013 was significantly greater than the combined expenditure on all other antihyperglycemic medications of $502.57 (95% CI, $430.37–$574.78).

The mean price per milliliter of insulin increased by 197% from $4.34 per milliliter (95% CI, $4.19-$4.51) in 2002 to $12.92 per milliliter (95% CI, $12.34-$13.50) in 2013, whereas the mean price of dipeptidyl peptidase-4 (DPP-4) inhibitors increased by 34% from $6.67 (95% CI, $6.26–$7.09) per tablet in 2006 to $8.92 (95% CI, $8.43-$9.41) in 2013. The mean price of metformin decreased by 93% from $1.24 per tablet (95% CI, $1.19–$1.29) in 2002 to $0.31 per tablet (95% CI, $0.25–$0.36) in 2013.

Discussion

Based on a nationally representative survey, the mean price of insulin increased from $4.34 per milliliter in 2002 to $12.92 in 2013. The estimated expenditure per patient for insulin in the United States in 2013 was greater than all other antihyperglycemic medications combined. Another factor contributing to the rise in expenditures on insulin was increased treatment intensity.

The mean price of insulin increased at a much faster rate than oral medications including DPP-4 inhibitors. We were unable to separate out generics from branded medications; however, unlike oral therapies, the mean price of insulin is unlikely to decline as a result of generic competition[5] because of the stringent regulations and substantial costs of bringing biosimilar insulins to market.

Limitations of our study included changes in editing rules for improved price benchmarking of the MEPS prescribed medicines data from 2007.[6] This may have artificially increased the reported drug expenditures by an estimated 10%.[6] Our reported estimates of expenditure and price did not include the cost of the various insulin delivery devices except prefilled pens.

Significant changes in mean price of insulin, relative to comparator therapies, suggest a need to reassess the effectiveness and cost-effectiveness of alternative antihyperglycemic therapies.

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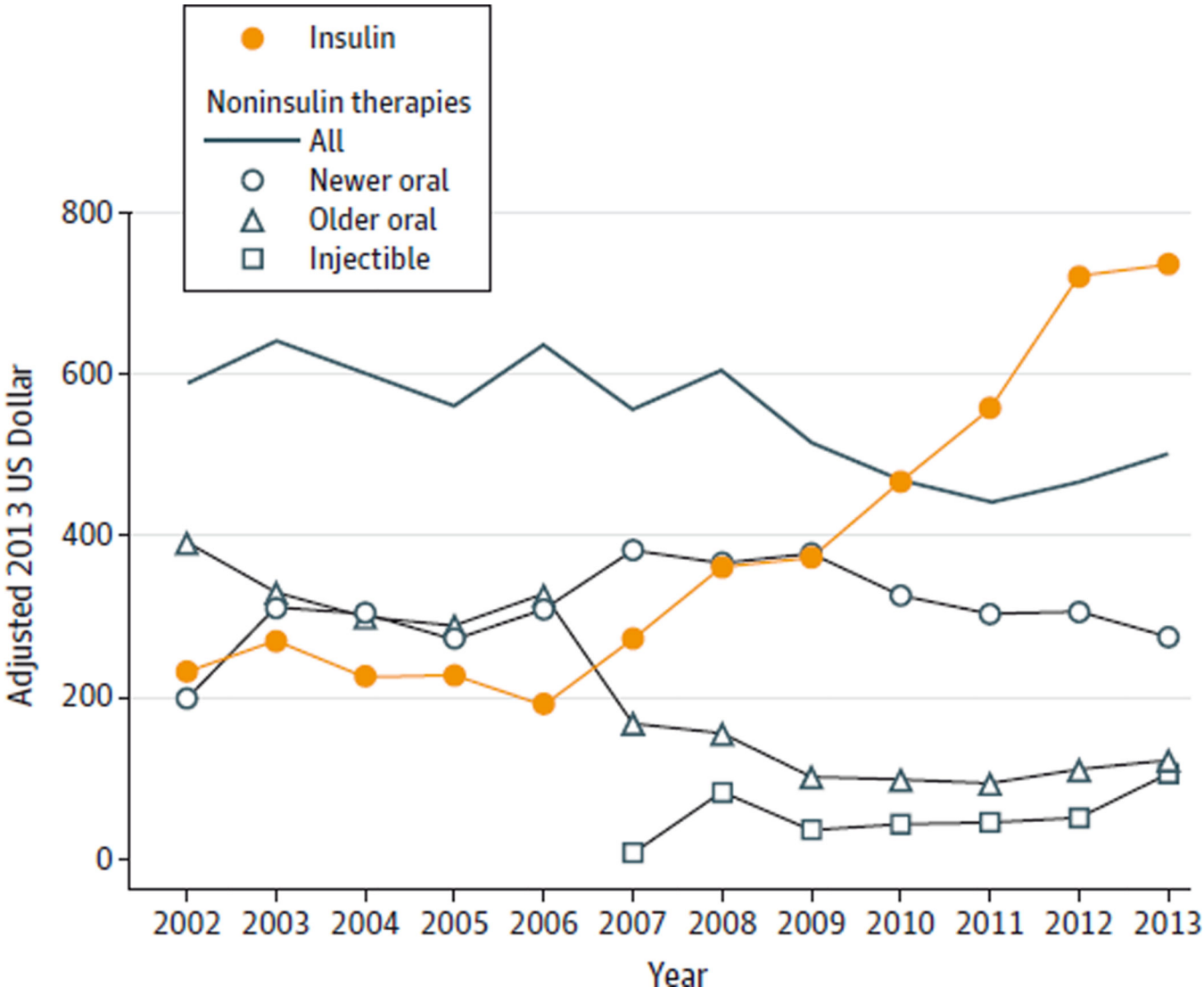

Figure. Mean Expenditure per Patient for Antihyperglycemic Medications, 2002–2013

Medications were classified as follows: insulin (human and analog); newer oral therapies (thiazolidinediones, dipeptidyl peptidase-4 inhibitors, and combinations); older oral therapies (metformin, sulfonylureas, α-galactosidase inhibitors, and nonsulfonylurea secretagogues); noninsulin-based injectable therapies (glucagon-like peptide-1 receptor agonists and amylin analogs).

Table

Weighted Characteristics of Treated Patients With Diabetes in the Medical Expenditure Panel Survey (MEPS), 2002–2013

Characteristics	MEPS Survey Years			
	2002–2004 (n = 5799)[a]	2002–2004 (n = 5799)[a]	2008–2010 (n = 7237)	2011–2013 (n = 8356)
Treated diabetes, % (95% CI)[b]	5.2 (4.9–5.4)	6.2 (5.9–6.5)	7.1 (6.8–7.4)	7.7 (7.4–8.0)
Age, mean (SD), y	60.2 (15.0)	60.3 (14.6)	60.3 (14.8)	60.7 (14.6)
Men, No. (%)	2496 (47.7)	2850 (48.3)	3182 (47.9)	3845 (50.0)
Race, No. (%)[c]				
White	2951 (65.3)	3209 (65.0)	3089 (64.9)	3210 (62.0)
Black	1202 (16.2)	1350 (15.1)	1805 (15.0)	2197 (15.5)
Hispanic	1334 (12.5)	1533 (13.5)	1699 (12.9)	2202 (15.1)
Others	312 (6.1)	394 (6.5)	644 (7.2)	747 (7.4)
Use of medications, % (95% CI)				
Insulin	28.1 (26.2–29.8)	24.1 (22.4–25.8)	25.3 (23.7–27.0)	29.2 (27.6–30.8)
Metformin	36.1 (34.2–38.0)	43.6 (41.6–45.5)	47.3 (45.4–49.2)	51.5 (49.8–53.1)
Sulfonylureas	38.2 (36.2–40.1)	35.1 (33.2–36.9)	30.7 (28.9–32.4)	27.5 (25.8–29.3)
Thiazolidinediones	21.1 (19.5–22.7)	23.2 (21.5–24.9)	13.0 (11.6–14.3)	5.8 (5.0–6.6)
α-Glucosidase inhibitors and nonsulfonylurea secretagogues	2.6 (2.0–3.2)	2.8 (2.2–3.4)	1.4 (1.0–1.8)	0.7(0.5–1.0)
DPP-4 inhibitors		1.2 (0.8–1.5)	5.6 (4.7–6.5)	7.7 (6.8–8.7)
Combinations	6.8 (5.8–7.7)	8.9 (7.8–9.9)	8.0 (7.0–9.0)	6.0 (5.1–6.9)
All orals[d]	68.9 (66.9–70.8)	72.6 (70.9–74.4)	70.8 (69.2–72.5)	69.5 (67.9–71.1)
Amylin analogs		0.1 (0–0.1)	0.2 (0.1–0.4)	0.1 (0–0.2)
GLP-1 receptor agonists			2.2 (1.6–2.8)	2.7 (2.1–3.4)
All noninsulin injectables[e]			2.4 (1.8–3.1)	2.8 (2.1–3.4)
Quantity of medications (95% CI)[f]				
Insulin, mL	171 (160–181)	150 (137–164)	205 (191–218)	206 (193–220)
All orals, tablets	611 (580–641)	632 (607–657)	775 (746–804)	800 (772–828)
All noninsulin injections, mL			21 (16–25)	36 (30–42)

Abbreviations: DPP-4, dipeptidyl peptidase-4; GLP-1, glucagon-like peptide-1.

[a] The reported statistics were based on a pooled sample across 3 waves of MEPS.

[b] Percentage of all survey respondents. People treated for diabetes were identified using 3-digit *International Classification of Diseases, Ninth Revision, Clinical Modification* diagnosis codes.

[c] Race was included as part of the descriptive analysis. As defined by MEPS, classification by race and ethnicity was mutually exclusive and based on information reported for each family member. All persons whose main national origin or ancestry was reported as Hispanic, regardless of racial background, were classified as Hispanic.

[d] Included metformin, sulfonylureas, thiazolidinediones, α-glucosidase inhibitors, and nonsulfonylurea secretagogues, combinations, and DPP-4 inhibitors.

[e] Included amylin analogs and GLP-1 receptor agonists from 2008.

[f] Quantities of medication used were means per patient per year, conditional on some recorded use of the drug over the given period.