

Memorandum

**Department of Health and Human Services
Public Health Service
Food and Drug Administration
Center for Drug Evaluation and Research**

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SUBJECT: One Year Post-Pediatric Exclusivity Post-marketing Adverse Event Review: Drug Use Data
Irbesartan (Avapro[®]): NDA 20-757
Pediatric Exclusivity Grant Date: September 16, 2004

****This document contains proprietary data which cannot be shared outside of FDA without clearance from the data vendor obtained through the Office of Drug Safety.****

EXECUTIVE SUMMARY

This consult examines drug utilization trends for Avapro[®] (irbesartan) in the pediatric population (ages 0-16 years), with primary focus on patterns of use one year before and one year following the granting of Pediatric Exclusivity for Avapro[®] on September 16, 2004. Proprietary drug use databases licensed by the Agency were used to conduct this analysis. IMS Health, National Sales Perspective[™] was used to determine the various retail and non-retail channels of distribution. Since the majority of use for this product occurs in the outpatient setting, we further examined the utilization patterns for Avapro[®] focusing on the outpatient setting. Outpatient use was measured by IMS Health's, National Disease and Therapeutic Index[™] (NDTI[™]), along with audits from Verispan, LLC, Vector One[™]: National (VONA) and Total Patient Tracker

(TPT). Outpatient drug utilization patterns were examined for the 3-year period from October 1, 2002 through September 30th, 2005.

The total number of prescriptions dispensed for Avapro[®] to the pediatric population ages 0-16 years old increased by approximately 33% from approximately 3,000 prescriptions dispensed in the 12-month period before the pediatric exclusivity was granted to an estimated 4,000 prescriptions in the following 12-month period. Dispensed prescriptions for Avapro[®] to the pediatric population aged 0-16 years old accounted for only 0.1% of the total dispensed Avapro[®] prescriptions during the pre- and post-pediatric exclusivity periods.

The number of pediatric patients ages 0-17 years receiving Avapro[®] has remained stable at less than 1,500 patients, representing less than 0.2% of all patients taking Avapro[®] over the three years of this analysis.

Internal medicine along with general practice/family practice/osteopathic medicine combined were the most frequent prescriber specialties associated with Avapro[®] mentions from October 2002- September 2005. Pediatricians ranked 11th in prescribing Avapro[®], accounting for less than 1% of all mentions of Avapro[®] in each of the three years surveyed in this analysis. The proportion of provider specialties prescribing Avapro[®] in the outpatient retail pharmacy settings showed no substantial change during the 36-month analysis period.

The most common diagnosis associated with a mention of Avapro[®] for adults during office-based physician-patient encounters was “Essential hypertension unspecified” (ICD-9 code 401.9), accounting for 78% of the mentions during the post-exclusivity period (October 2004 - September 2005). “Chronic ischemic diseases with hypertension “ (ICD-9 code 414.5) accounted for only 4% of the mentions during that time period. There were no pediatric diagnoses associated with Avapro[®] or Avalide[®] mentioned from October 2002- September 2005.

In summary, Avapro[®] usage in the pediatric and adult population has increased over the past three years. Pediatric patients account for less than 0.2% of all patients receiving Avapro[®]. Dispensed prescriptions for Avapro[®] to the pediatric population aged 0-16 years old accounted for less than 0.1% of the total dispensed prescriptions for that product during the time periods before and after the pediatric exclusivity was granted.

INTRODUCTION

On January 3, 2001, Congress enacted the Best Pharmaceuticals for Children Act (BPCA) to improve the safety and efficacy of pharmaceuticals for children. Section 17 of that Act requires the reporting of adverse events associated with the use of a drug in children during the one year following the date on which the drug received marketing exclusivity. In support of this mandate, the FDA is required to provide a report to the Pediatric Advisory Committee on the drug utilization patterns and adverse events associated with the use of the drug on a quarterly basis. This review is in addition to the routine post-marketing safety surveillance activities the FDA performs for all marketed drugs.

Irbesartan (Avapro[®], NDA 20-757), an angiotensin II receptor (AT1 subtype) antagonist, was approved on September 30, 1997 for the treatment of hypertension alone or in combination with other hypertensive agents. Avapro[®] is also indicated for the treatment of diabetic nephropathy with an elevated serum creatinine and proteinuria (>300mg/day) in patients with type 2 diabetes and hypertension. In this population, Avapro[®] reduces the rate of progression of nephropathy as measured by the occurrence of doubling serum creatinine or end-stage renal disease (need dialysis or renal transplantation). Irbesartan has been given a pregnancy category C (*first trimester*) and category D (*second and third trimester*). At this time, there are no approved pediatric indications and no labeling for use in patients under the age of 16 years. Avapro[®] is available as white to off-white biconvex oval tablets contain 75 mg, 150 mg, or 300 mg of irbesartan. Irbesartan is also available combined with hydrochlorothiazide marketed under the brand name Avalide[®] (NDA 20-758).

The Pediatric Exclusivity Board of the FDA granted pediatric exclusivity for Avapro[®] (NDA 20-757) on September 16, 2004. No changes to the product labeling have been made since this exclusivity was granted. This review describes outpatient drug use patterns for Avapro[®] in the pediatric and adult population in the years before and after granting the pediatric exclusivity. Proprietary drug use databases licensed by the Agency were used to conduct this analysis.

METHODS

Setting of Use

IMS Health, National Sales Perspectives[™] data (see Appendix) were used to determine the setting in which Irbesartan was sold. Sales of this product by number of tablets sold from the manufacturer to various retail and non-retail channels of distribution were analyzed for three 12-month time periods from October 2002 through September 2005 (Table 1). It was clear from these data that this product was sold mainly to the retail settings; ~90% of all tablets sold were to retail pharmacies during the 12-month period from October 2004 through September 2005.

We therefore examined the utilization patterns for Avapro[®] focusing on the outpatient setting only. Outpatient use was measured by IMS Health's, National Disease and Therapeutic Index[™] (NDTI[™]), along with audits from Verispan, LLC, Vector One[™]: National (VONA) and Total Patient Tracker (TPT) (see Appendix). Outpatient drug utilization patterns were examined for the 3-year period from October 1, 2002 through September 30th, 2005. In order to put drug

utilization of Avapro[®] into context, we compared drug utilization of irbesartan (both Avapro[®] and Avalide[®]) to other products from similar antihypertensive therapeutic classes: angiotensin converting enzyme inhibitors (USC5-31111), angiotensin II receptor antagonists (USC5-31121), and angiotensin II receptor antagonists-combined with hydrochlorothiazide (USC5-31122). Estimates on the **number of patients** receiving Avapro[®] from retail pharmacies were provided.

Table 1. Total Number of Tablets (in thousands) of Avapro[®] and Avalide[®] Sold to U.S. Distribution Channels During October 2002 – September 2005, IMS National Sales Perspectives[™]

	October 2002 – September 2003		October 2003 – September 2004		October 2004 – September 2005	
	N (000)	%	N (000)	%	N (000) [†]	%
Avapro[®] (irbesartan)	277,055	(100)	312,293	(100)	323,976	(100)
Retail*	248,573	(90)	279,147	(90)	288,510	(90)
Non-Retail**	28,482	(10)	33,146	(10)	35,465	(10)
Avalide[®] (irbesartan/HCTZ)	115,620	(100)	152,099	(100)	176,011	(100)
Retail*	111,546	(96)	146,282	(96)	169,091	(96)
Non-Retail**	4,074	(4)	5,817	(4)	6,920	(4)

*Retail includes chain, independent, mail order, long term care and food store pharmacies

**Non-retail includes Non-federal hospitals, federal facilities, clinics, HMOs, home health care, prisons, universities, and other IMS Health, IMS National Sales Perspectives[™] Combined, MAT October 2002 to September 2005, Data Extracted 10-31-2005

(Original files: 0510ava1.xls)

[†]Subtotals may not sum exactly due to rounding error

RESULTS

I. Dispensed Prescriptions

Outpatient prescriptions dispensed for angiotensin converting enzyme (ACE) inhibitors-alone (USC5 31111) as a class increased by approximately 2% from the pre-exclusivity period (October 2003 - September 2004) to the post-exclusivity period (October 2004 - September 2005), with approximately 97 million prescriptions dispensed nationally in the post-exclusivity period (Table 2). During the same time period, prescriptions dispensed for angiotensin II receptor antagonists-alone (USC5 31121) increased by approximately 9%, with approximately 35 million prescriptions dispensed in the post-exclusivity period. Prescriptions dispensed for angiotensin II receptor antagonists/HCTZ (USC5-31122) increased by almost 20%, with approximately 27 million prescriptions dispensed nationally in the post-exclusivity period.

The number of outpatient prescriptions dispensed for Avapro[®] increased by approximately 10% from 5.3 million prescriptions dispensed during the pre-exclusivity period (October – September 2004) to approximately 5.8 million prescriptions dispensed during the post-exclusivity period (October 2004 to September 2005). Both Avapro[®] and Avalide[®] ranked third in their respective therapeutic drug class in terms of the number of prescriptions dispensed nationwide.

Table 2. Total Number of Prescriptions Dispensed (in thousands) in Retail Pharmacies Nationwide for Angiotensin Converting Enzyme Inhibitors, Renin Angiotensin II Receptor Antagonists and Renin Angiotensin II Receptor Antagonists-with HCTZ Market During October 2002 – September 2005, Verispan LLC: VONA

	October 2002 – September 2003		October 2003 – September 2004		October 2004 – September 2005	
	N (000)	(%)	N (000)	(%)	N (000)	(%)
GRAND TOTAL	141,854	(100)	149,760	(100)	158,643	(100)
ACE Inhibitors-Alone (USC5 31111)	94,519	(66.6)	94,725	(63.3)	96,622	(60.9)
Renin Angiotensin II Receptor Antagonists-Alone (USC5 31121)	29,655	(20.9)	32,681	(21.9)	35,494	(22.4)
Valsartan (Diovan®)	10,333	(34.8)	11,460	(34.9)	12,259	(35.3)
Losartan (Cozaar®)	8,339	(28.1)	8,464	(25.8)	8,347	(23.5)
Irbesartan (Avapro®)	4,893	(16.5)	5,292	(16.1)	5,811	(16.4)
Olmesartan Medoxomil (Benicar®)	1,677	(5.7)	3,341	(10.2)	4,573	(12.9)
Candesartan (Atacand®)	2,841	(9.6)	2,589	(7.9)	2,362	(6.7)
Telmisartan (Micardis®)	1,297	(4.4)	1,428	(4.3)	1,578	(4.4)
Eprosartan (Teveten®)	275	(0.9)	287	(0.9)	295	(0.8)
Renin Angiotensin II Receptor Antagonists with Hydrochlorothiazide (USC5 31122)	17,680	(12.5)	22,174	(14.8)	26,526	(16.7)
Vasartan/HCTZ (Diovan HCT®)	7,424	(42)	9,023	(40.7)	10,249	(38.6)
Losartan/HCTZ (Hyzaar®)	6,173	(34.9)	6,494	(29.3)	6,500	(24.5)
Irbesartan/HCTZ (Avalide®)	2,445	(13.8)	3,089	(13.9)	3,756	(14.2)
Olmesartan Medoxomil (Benicar HCT®)	18	(0.1)	1,485	(6.7)	3,570	(13.5)
Candesartan Cilexetil (Atacand HCT®)	985	(5.6)	1,103	(5.0)	1,122	(4.2)
Telmisartan/HCTZ (Micardis HCT®)	607	(3.4)	849	(3.8)	1,110	(4.2)
Eprosartan HCTZ (Teveten HCT®)	29	(0.2)	130	(0.6)	219	(0.8)

Verispan, LLC, October 2002 – September 2005, Data Extracted 10-31-2005 (File:D040614 avapro BPCA Class TRx .qry)

† Subtotals may not sum exactly due to rounding error

Prescriber Specialty

Internal medicine along with family medicine, general practice, and osteopathic medicine (GP/FM/DO) were the most frequent prescriber specialties associated with dispensed prescriptions for Avapro[®], accounting for over 70% of the total number of prescriptions dispensed during the three 12-month time period (Table 3). Cardiologists ranked third in Avapro[®] prescribing, accounting for an estimated 8% of the dispensed prescriptions for Avapro[®]. Pediatricians ranked 11th in prescribing Avapro[®], accounting for less than 1% of all mentions of Avapro[®] in each of the three years surveyed in this analysis. In general, the proportion of provider specialties prescribing Avapro[®] in the outpatient retail pharmacy settings showed no substantial change during the 36-month study period.

Table 3. Total Number of Prescriptions Dispensed (in thousands) for Avapro[®] Nationwide by Physician Specialty During October 2002 – September 2005, Verispan LLC: VONA

Rank	Prescriber Specialty	October 2002 – September 2003		October 2003 – September 2004		October 2004 – September 2005	
		N (000)**	(%)	N (000)**	(%)	N (000)**	(%)
	All Prescriber Specialties	4,893	(100.0)	5,292	(100.0)	5,811	(100.0)
1 st	Internal Medicine	1,877	(38.4)	2,004	(37.9)	2,194	(37.8)
2 nd	GP/FM/DO*	1,644	(33.6)	1,752	(33.1)	1,935	(33.3)
3 rd	Cardiology	432	(8.8)	445	(8.4)	485	(8.3)
4 th	Unspecified	335	(6.8)	410	(7.7)	427	(7.3)
5 th	Nephrology	94	(1.9)	113	(2.1)	132	(2.3)
11 th	Pediatrics	33	(0.7)	38	(0.7)	43	(0.7)
	Other Specialties	473	(~10)	528	(~10)	598	(~10)

Verispan, LLC, October 2002 – September 2005, Data Extracted 10-31-2005 (File: D040641 Avapro BPCA Specialty.qry)

* General Practice, Family Medicine & Osteopathic physicians

** Subtotals may not sum exactly due to rounding error

II. Patient Demographics

Prescriptions dispensed for Avapro[®] to the pediatric population ages 0-16 years old increased by approximately 33%, from roughly 3,000 prescriptions dispensed in the pre-exclusivity period of October 2003 –September 2004 to approximately 4,000 prescriptions dispensed in the post-exclusivity period of October 2004-September 2005. (Table 4). Dispensed prescriptions of Avapro[®] to the pediatric population aged 0-16 years old accounted for approximately 0.1% of the total dispensed Avapro[®] prescriptions during the time periods before and after the pediatric exclusivity was granted. Due to the small volume of dispensed prescriptions in the pediatric population, we were unable to determine use in individual pediatric subgroups.

Table 4. Outpatient Prescriptions Dispensed for Avapro[®] by Age Groups During October 2002 – September 2005, Verispan LLC: VONA

	October 2002 – September 2003		October 2003 – September 2004		October 2004 – September 2005	
	N(000)	(%)	N (000)*	(%)	N (000)	(%)
Avapro[®]	4,893	(100.0)	5,292	(100.0)	5,811	(100.0)
Age 0-16	3	(0.1)	3	(0.1)	4	(0.1)
Age 17+	4,880	(99.7)	5,263	(99.5)	5,777	(99.4)
Age Unspecified	10	(0.2)	25	(0.4)	30	(0.5)

Verispan, LLC, October 2002 – September 2005, Data Extracted 10-31-2005 (File: D040641 Avapro BPCA Class TRx.qry)

* Subtotals may not sum exactly due to rounding error

Over the 3 years of this analysis, the **estimated number of patients** receiving Avapro[®] therapy has been relatively stable.(data not shown). The number of pediatric patients ages 0-17 years receiving Avapro[®] has remained stable at approximately less 1,500 patients, representing less than 0.2% of all patients using Avapro[®] over the three-year period. The number of adult patients using Avapro[®] has also remained stable at approximately one million.

III. Indications for Use

The most common diagnosis associated with a mention of Avapro[®] for adults during office-based physician-patient encounters was “Essential hypertension unspecified” (ICD-9 code 401.9) accounting for 78% of mentions during the post-exclusivity period (October 2004 - September 2005). “Chronic ischemic diseases with hypertension “(ICD-9 code 414.5) accounted for only 4% of the mentions during that time period (Table 6). Because use of Avapro[®] in the pediatric population is so small, the audit used to capture diagnoses did not record any diagnoses data for patients aged 0-16 with from October 2002- September 2005.

Table 6. Top Diagnoses (in thousands) Associated with Mentions of Avapro® for the Pediatric and Adult Population from October 2002 - September 2005, IMS National Disease and Therapeutic Index™

IMS Reported ICD-9 Codes	October 2002 – September 2003		October 2003 – September 2004		October 2004 – September 2005	
	N (000)	(%)	N (000)	(%)	N (000)	(%)
Avapro® Total Mentions	2,324	(100.0)	2,464	(100.0)	2,417	(100.0)
Age 17+ Years	2,234	(100)	2,464	(100)	2,417	(100.0)
401.9 Essential hypertension unspecified	1,738	(74.8)	1,903	(77.2)	1,888	(78.1)
414.5 Chronic ischemic disease unspecified with hypertension	67	(2.9)	47	(1.9)	95	(3.9)
402.9 Hypertensive heart disease unspecified	69	(3)	136	(5.5)	77	(3.2)
Other Diagnoses (6)	519	(19.4)	377	(15.3)	357	(14.8)
Age 1-16 Years	-----	-----	-----	-----	-----	-----

IMS National Disease and Therapeutic Index™ CD-ROM, NDTI 3yr. October 2002-September 2005. Data extracted 11-2005 (File.avapro_aveliedbydiag4age.xls)

DISCUSSION

Based on the databases used for this consult, the use of angiotensin converting enzyme (ACE) inhibitors remained stable during the three 12-month periods, yet total dispensed prescriptions for angiotensin II receptor antagonists and specifically Avapro® has been increasing from the pre- to the post-exclusivity periods. Nonetheless, the use of Avapro® in the pediatric population aged 0-16 years remained very low, with the majority of use of this product in adults.

The low use of Avapro® in pediatric population is consistent with the known epidemiology of hypertension in that population. The limited data available suggest that the prevalence of systolic or diastolic hypertension is <5% among children and adolescents.^{1,2,3} Elevated systolic blood pressure appears to be more common than elevated diastolic blood pressure in children.⁴ Even with the accumulated data on the relationship between childhood and adult blood pressures, hypertension is still under-recognized clinically in children, possible due to the normal age-related increase in blood pressure throughout childhood.^{4,5} In addition, the outcomes associated with hypertension of atherosclerotic disease and overt cardiovascular morbidity are not common in the majority of hypertensive children.

¹ Adrogué HE, Sinaiko AR. Prevalence of hypertension in junior high school-aged children: effect of new recommendations in the 1996 Updated Task Force Report. *Am J Hypertens.* 2001 May;14(5 Pt 1):412-4

² Sinaiko AR, Gomez-Marín O, Prineas RJ. Prevalence of "significant" hypertension in junior high school-aged children: the Children and Adolescent Blood Pressure Program. *J Pediatr.* 1989 Apr;114(4 Pt 1):664-9

³ Rosner B, Prineas R, Daniels SR, Loggie J. Blood pressure differences between blacks and whites in relation to body size among US children and adolescents. *Am J Epidemiol.* 2000 May 15;151(10):1007-19

⁴ Sorof JM. Prevalence and consequence of systolic hypertension in children. *Am J Hypertens.* 2002 Feb;15(2 Pt 2):57S-60S

⁵ Fernandes E, McCrindle BW. Diagnosis and treatment of hypertension in children and adolescents. *Can J Cardiol.* 2000 Jun;16(6):801-11

Findings from this consult should be interpreted in the context of the known limitations of the databases used. We estimated that the use of Avapro[®] was mostly in the outpatient settings based on the IMS Health, National Sales Perspectives[™]. These data do not provide a direct estimate of use but do provide a national estimate of units sold from the manufacturer to various channels of distribution. The amount of product purchased by these retail and non-retail channels of distribution may be a possible surrogate for use, if we assume that facilities purchase drugs in quantities reflective of actual patient use.

While we conducted a comprehensive analysis of the use of this product in the outpatient settings, in which the majority of use occurred, use outside of the retail pharmacy settings was not captured in our analysis.

Throughout our analysis, we used the agency's cut-off age definition of a pediatric patient (age 0-16 years), except when we use the Total Patient Tracker tool for providing estimates of the total number of unique patients receiving prescriptions for Avapro[®] through retail pharmacies and mass merchandisers. Age bands available through this data resource with an age break at age 17 years are fixed and cannot yet be customized to reflect the agency's definition. In addition, using this tool does not allow summary of age bands in each time period, due to patient aging in the course of the study period.

NDTI[™] data provide estimates of patient demographics and indications for use of medicinal products in the U.S. Due to the sampling and data collection methodologies, the small sample size can make these data unstable, particularly when use is not common in the pediatric population, as in the case of Avapro[®].

CONCLUSION

In summary, Avapro[®] usage in the pediatric and adult population has increased over the past three years. Pediatric patients account for less than 0.2% of all patients receiving Avapro[®]. Dispensed prescriptions for Avapro[®] for pediatric patients aged 0-16 years old accounted for less than 0.1% of total dispensed prescriptions for that product during the time periods before and after the pediatric exclusivity was granted.

APPENDIX

IMS HEALTH, IMS NATIONAL SALES PERSPECTIVES™

IMS Health National Sales Perspectives™ measures the volume of drug products (both prescription and over-the-counter) and selected diagnostic products moving from manufacturers into various outlets within the retail and non-retail markets. Outlets within the retail market include the following pharmacy settings: chain drug stores, independent drug stores, mass merchandisers, food stores, and mail service. Outlets within the non-retail market include clinics, non-federal hospitals, federal facilities, HMOs, long-term care facilities, home health care, and other miscellaneous settings. IMS Health, National Sales Perspectives™ measures the volume of drug products moving from manufacturer into retail and non-retail settings in terms of sales dollars, vials, and market share. These data are based on national projections.

For this analysis, the sales trends of oral irbesartan and irbesartan/HCTZ were examined from October 1, 2002 – September 30, 2005 inclusive.

VERISPAN, LLC

Vector One™: National (VONA)

Verispan's VONA measures retail dispensing of prescriptions or the frequency with which drugs move out of retail pharmacies into the hands of consumers via formal prescriptions. Information on the physician specialty, the patient's age and gender, and estimates for the numbers of patients that are continuing or new to therapy are available.

The Vector One™ database integrates prescription activity from a variety of sources including national retail chains, mass merchandisers, pharmacy benefits managers and their data systems, and provider groups. Vector One™ receives over 1.8 billion prescription claims, representing over 150 million unique patients.

The number of dispensed prescriptions is obtained from a sample of virtually all retail pharmacies throughout the U.S and represents approximately half of the retail prescriptions dispensed nationwide. Verispan receives all prescriptions from approximately one-third of the stores and a significant sample of prescriptions from the remaining stores.

Data for this analysis included all oral renin angiotensin II receptor antagonists-alone, angiotensin II receptor antagonists-combination, and angiotensin converting inhibitors-alone prescriptions dispensed from October 1, 2002 – September 30, 2005 inclusive.

VERISPAN, LLC

Vector One™: Total Patient Tracker (TPT)

Verispan's Total Patient Tracker is a national-level projected audit designed to estimate the total number of unique patients across all drugs and therapeutic classes.

TPT derives its data from the Vector One™ database which integrates prescription activity from a variety of sources including national retail chains, mass merchandisers, pharmacy benefits managers and their data systems, physician offices and hospitals. Vector one receives over 1.8 billion prescription claims per year, which represents over 150 million patients tracked across time.

Data for this analysis included all Avapro® patients from October 1, 2002 – September 30, 2005 inclusive.

IMS HEALTH, NATIONAL DISEASE AND THERAPEUTIC INDEX™ (NDTI™)

The National Disease and Therapeutic Index™ (NDTI™) is an ongoing survey designed and conducted by IMS Health to provide descriptive information on the patterns and treatment of disease encountered in office-based practices in the continental U.S. The data are collected from a panel of approximately 3,000 office-based physicians who complete and submit a survey of their practice patterns to IMS Health for two consecutive days per quarter. These data may include profiles and trends of diagnoses, patients, drug products mentioned, and treatment patterns. These data are projected nationally to reflect national prescribing patterns.

NDTI™ uses the term drug uses for mentions of a drug in association with a diagnosis during an office-based patient visit. This term may be duplicated by the number of diagnosis for which the drug is mentioned. It is important to note that a drug use does not necessarily result in prescription being generated. Rather, the term indicates that a given drug was mentioned during an office visit.

For this analysis, we examined annual mentions of Avapro® during office-based physician visits during the time period from October 1, 2002 – September 30, 2005 inclusive.

Concurrences:

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