BARCLAYS

Credit Research
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High Yield Pharmaceuticals

Capturing the HY Pharma OID – Opioid Investing Discount

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We estimate potential opioid liabilities for TEVA, ENDP and MNK based on ARCOS data recently released and available on the DEA site and our culpability scores. We also provide a brief review of the case below.

There are broader implications, as these data include distributors (covered by Brittany Chen) and pharmacies (covered by Hale Holden and Britten Chen); however, given the amount of time needed to analyze it, we have mostly focused on high-yield manufacturers in this report.

The data deepen our conviction on all three credits.

- Of the three credits, we believe ENDP trading levels are more intertwined with the outcome of this case and expect the returns to exceed MNK and TEVA if the settlement is allocated according to our estimates. On the other hand, the MNK 2023 non-guaranteed and the long-dated TEVA non-guaranteed unsecured notes are structurally junior to these opioid liabilities and, we think, are mispriced. The short-dated TEVA notes (2021 and 2.95% 2022) are attractive, as the company has options to address these maturities with guaranteed unsecured debt (and possibly maintain BB ratings).
- In our view, all three credits generate sufficient FCF to absorb these opioid liabilities. While the pressure may be manageable over time, the weight of other liabilities, such as alleged price fixing (mostly Teva), CMS lawsuits (MNK), alleged kickbacks (Teva and MNK) and whistleblowing (MNK) may further pressure trading levels.
- We believe subjectively allocating fines to bankrupt companies is illogical. Rather, we believe these liabilities will allocate mostly on the ability to pay. We also do not believe a settlement is possible without all attorneys general and multi-district litigation (MDL) plaintiffs agreeing to settle.
- While plaintiff attorneys may have funding sources, we expect a settlement within 1-2 years and estimate these liabilities will be paid over 20-30 years.

PLEASE SEE ANALYST CERTIFICATIONS AND IMPORTANT DISCLOSURES STARTING AFTER PAGE 60

FIGURE 1
Summary of top ideas and ratings

Ticker	Trade Ideas
TEVA	Swap out of TEVA 6.15% and into TEVA 2.95%
TEVA	Sell TEVA 6.75% 2028, Buy TEVA 6% 2024
Ticker	**Ratings**
ENDP	Overweight Secured Notes, Unsecured Notes
MNK	Overweight 2020, Underweight remaining tranches
TEVA	Overweight 2.2% 2020, 3.65% 2021, 3.65% 2021, 2.95% 2022; Market Weight 2020s; 0.5% 2022; Underweight remaining

Source: Barclays Research

Top Ideas

Maintain Overweight ENDP 2027 secureds. ENDP is our focus credit, and we believe the liabilities are manageable over 20-30 years. These first lien notes trade at an attractive discount; the liens have been perfected; and in our opinion, the notes are effectively and structurally ahead of the opioid liabilities.

Maintain Overweight ENDP 2023 unsecureds and 2025 unsecureds. We believe the risk/reward is attractive. The bonds have subsidiary guarantees the (subsidiaries not named generate 65-70% of total EBITDA), Vasostrict may withstand ANDA filings (the Markman ruling was favorable) and FCF is strong. The last should allow the company to manage the liability estimate over 20-30 years.

Maintain Overweight MNK 2020 unsecureds. Depending on the CMS outcome, the company may use either FCF, a smaller A/R facility (the original facility may have been terminated due to representation concerns) and/or its secured capacity to address the 2020 notes. At current levels, an exchange may be more likely (the company may waive guarantees with a majority in principal of holders or may need at least 66 2/3% if the guarantee [individually or in aggregate] accounts for greater than 75% of assets or 75% of LTM EBITDA). Furthermore, bringing back opioid liabilities into the credit may propel holders to push for an exchange into the secureds sooner.

Maintain Underweight the remaining MNK unsecureds. We believe the 2023 non-guaranteed notes are mispriced, given the estimated opioid liabilities (nearly 3x EBITDA) and CMS liability and subordinated position relative to them. The remaining unsecured notes will likely remain under pressure until these liabilities are understood. The company could consider an aggressive exchange of its unsecured into secured, but there are challenges, and amendments must be considered.

Maintain Overweight TEVA 2021 and 2.95% 2022 notes. Despite the pressure from opioid liabilities, the company has options to address its near-dated maturities, specifically with unsecured guaranteed debts.

Buy TEVA 2024, Sell TEVA 2028. Buy 2.95% 2022, Sell 6.15% 2036 We maintain our Underweight on these unsecured notes; however, we believe the curve should be steeper, given the opioid liability risk. Both the 2024 and 2028 notes trade even yield, and this swap shortens duration. With the second idea, holders give up points but pick up yield and shorten duration. While these liabilities may be addressed over 20-30 years and may be manageable,

given its FCF, there are certain risk considerations. First, TEVA faces roughly $15bn maturities over the next four years, and interest expense may materially increase over this timeframe (the company could issue guaranteed unsecured euro and USD notes, and the structural positioning may benefit interest expense). Second, while a few years from settling, the weight of other litigation liabilities cannot be dismissed and may have to be paid over shorter period. Third, these litigation liabilities (targeting TEVA's subsidiaries) are ahead of the unsecured non-guaranteed notes (no sub guarantees), which may lead to ratings downgrades. Fourth, management's decision to wait to issue new non-guaranteed debt may be costly (interest expense may double). The company could consider exchanges to take advantage of current discounts. It could also issue secured debt and intentionally trip the negative pledge (and securitize all debt), but there may be challenges to this strategy.

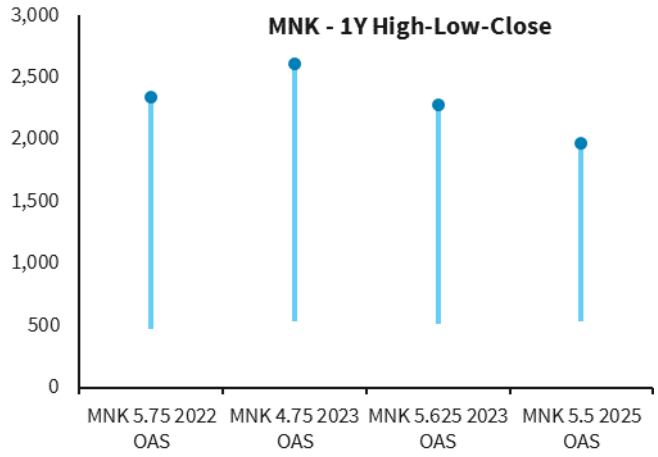
FIGURE 2
Pharma Pricing

					Issue Rating		Date: 8/16/19			STW chg	Next	Call		LTM	
Ticker	Coupon	Security	Size	Maturity	M	S&P	Price	YTW	STW	7/26/19	call	Price	Ratings	Cov	Lev
ENDO HEALTH SOLUTIONS INC															
ENDP	L+425	1L TERM B	3,347	4/27/2024	B1	/ B+	91.500	8.677%	651	(15)				2.5x	4.1x
ENDP	5.875%	1st lien	300	10/15/2024	B1	/ B+	91.000	8.039%	661	5	4/15/2020	102.938	OW	2.5x	4.1x
ENDP	7.500%	Secured	1,500	4/1/2027	B1	/ B+	91.500	9.067%	754	21	4/1/2022	105.625	OW	2.5x	4.1x
ENDP	6.000%	Sr Unsec	1,440	7/15/2023	Caa2	/ CCC+	63.500	19.862%	1,844	34	cc	103.000	OW	2.5x	6.5x
ENDP	6.000%	Sr Unsec	1,200	2/1/2025	Caa2	/ CCC+	59.500	17.951%	1,653	72	2/1/2020	103.000	OW	2.5x	6.5x
MALLINCKRODT INTERNATIONAL															
MNK	L+275	1L TERM B	1,525	9/24/2024	Ba3	/ BB	81.000	9.793%	763	157				3.6x	2.1x
MNK	L+300	1L TERM B	405	2/24/2025	Ba3	/ BB	81.000	9.800%	763	110				3.6x	2.1x
MNK	4.875%	Gtd Sr Nts	700	4/15/2020	B3	/ B+	86.250	29.370%	2,787	1,287	cc	100.000	OW	3.6x	4.1x
MNK	5.750%	Gtd Sr Nts	663	8/1/2022	B3	/ B+	63.250	23.775%	2,233	749	cc	101.438	UW	3.6x	4.1x
MNK	5.625%	Gtd Sr Nts	680	10/15/2023	B3	/ B+	56.000	22.439%	2,101	439	cc	104.219	UW	3.6x	4.1x
MNK	5.500%	Gtd Sr Nts	596	4/15/2025	B3	/ B+	50.000	21.009%	1,959	344	4/15/2020	102.750	UW	3.6x	4.1x
MNK	4.750%	Not Gtd Sr Nts	527	4/15/2023	Caa1	/ B-*-	48.000	28.571%	2,715	1,039			UW	3.6x	4.4x
TEVA PHARMACEUTICALS															
TEVA	2.250%	Sr Unsec	700	3/18/2020	Ba2	/ BB	99.250	3.564%	207	8			MW	5.3x	6.2x
TEVA	0.375%	Sr Unsec	2,152	7/25/2020	Ba2	/ BB	97.500	3.136%	396	135			MW	5.3x	6.2x
TEVA	2.200%	Sr Unsec	3,000	7/21/2021	Ba2	/ BB	92.000	6.704%	521	170			OW	5.3x	6.2x
TEVA	3.650%	Sr Unsec	588	11/10/2021	Ba2	/ BB	92.500	7.362%	587	207			OW	5.3x	6.2x
TEVA	3.650%	Sr Unsec	613	11/10/2021	Ba2	/ BB	92.500	7.362%	587	207			OW	5.3x	6.2x
TEVA	0.500%	Sr Unsec	362	7/28/2022	Ba2	/ BB	86.000	5.814%	702	187			MW	5.3x	6.2x
TEVA	2.950%	Sr Unsec	844	12/18/2022	Ba2	/ BB	84.000	8.571%	712	267			OW	5.3x	6.2x
TEVA	3.250%	Sr Unsec	863	4/15/2022	Ba2	/ BB	91.500	6.916%	789	302			UW	5.3x	6.2x
TEVA	1.250%	Sr Unsec	1,593	3/31/2023	Ba2	/ BB	82.000	7.062%	804	203	12/31/2022	100.000	UW	5.3x	6.2x
TEVA	2.800%	Sr Unsec	3,000	7/21/2023	Ba2	/ BB	81.375	8.480%	706	242			UW	5.3x	6.2x
TEVA	6.000%	Sr Unsec	1,250	4/15/2024	Ba2	/ BB	85.500	9.964%	854	238	1/15/2024	100.000	UW	5.3x	6.2x
TEVA	1.125%	Sr Unsec	1,837	10/15/2024	Ba2	/ BB	73.750	7.438%	838	227			UW	5.3x	6.2x
TEVA	4.500%	Sr Unsec	1,109	3/1/2025	Ba2	/ BB	83.000	8.581%	951	274	12/1/2024	100.000	UW	5.3x	6.2x
TEVA	1.000%	Sr Unsec	362	7/28/2025	Ba2	/ BB	76.750	5.726%	693	176			UW	5.3x	6.2x
TEVA	3.150%	Sr Unsec	3,500	10/1/2026	Ba2	/ BB	72.250	8.410%	688	167			UW	5.3x	6.2x
TEVA	1.875%	Sr Unsec	859	3/31/2027	Ba2	/ BB	66.000	8.007%	893	221	12/31/2026	100.000	UW	5.3x	6.2x
TEVA	6.750%	Sr Unsec	1,760	3/1/2028	Ba2	/ BB	83.000	9.727%	820	159	12/1/2027	100.000	UW	5.3x	6.2x
TEVA	1.625%	Sr Unsec	915	10/15/2028	Ba2	/ BB	67.000	6.524%	741	138			UW	5.3x	6.2x
TEVA	6.150%	Sr Unsec	789	2/1/2036	Ba2	/ BB	79.500	8.484%	652	90			UW	5.3x	6.2x
TEVA	4.100%	Sr Unsec	2,000	10/1/2046	Ba2	/ BB	65.000	6.997%	503	77			UW	5.3x	6.2x

* Private Company / ** Ratings Suspended/Restricted

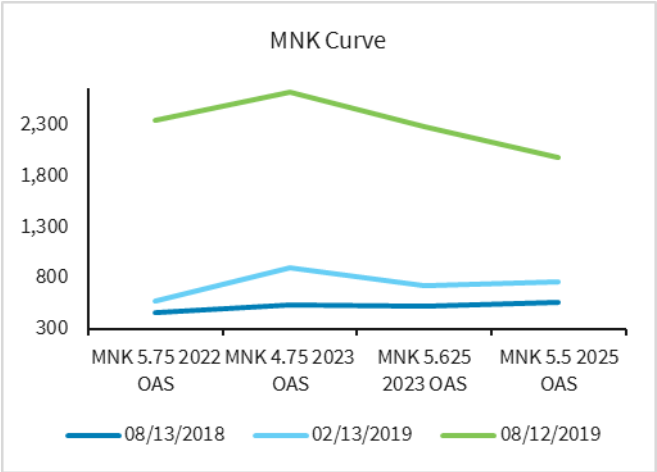
Source: Bloomberg, company filings, Barclays Research

FIGURE 3
MNK Bonds OAS



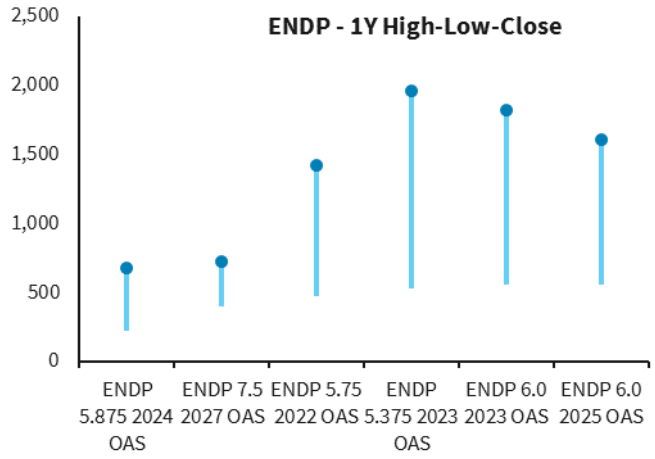
Source: Barclays Live, Barclays Research

FIGURE 4
MNK Yield Curves



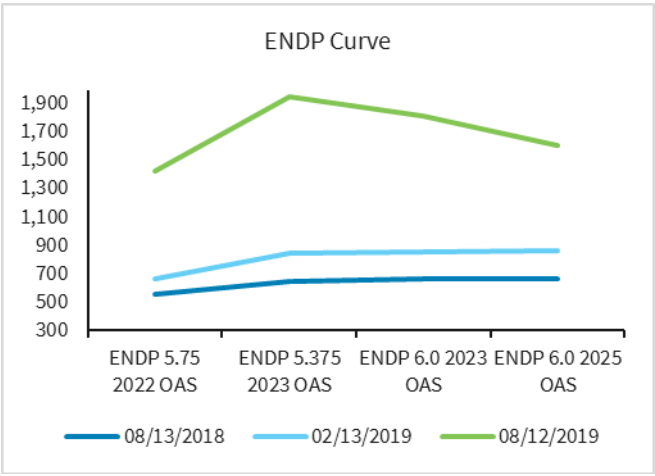
Source: Barclays Live, Barclays Research

FIGURE 5
ENDP Bonds OAS



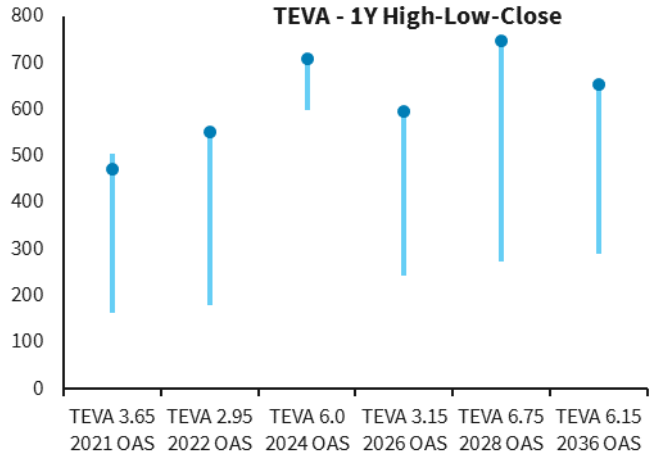
Source: Barclays Live, Barclays Research

FIGURE 6
ENDP Yield Curves



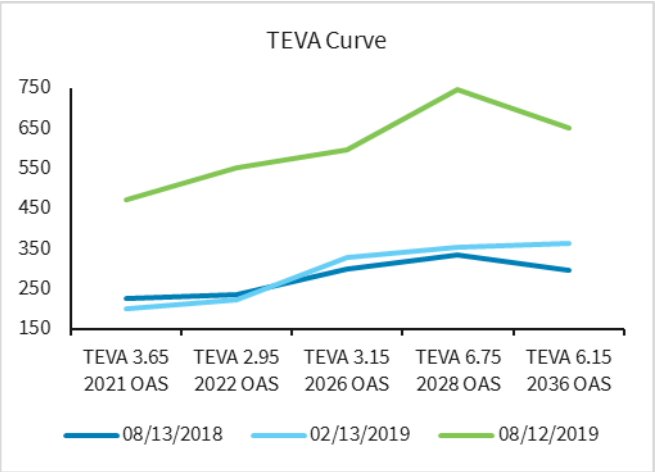
Source: Barclays Live, Barclays Research

FIGURE 7
TEVA Bonds OAS



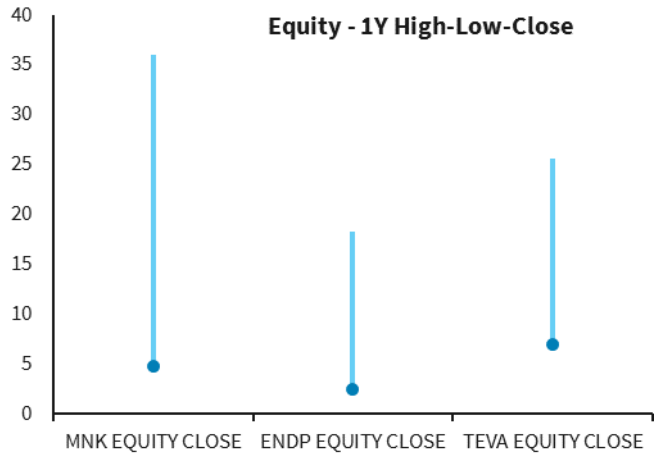
Source: Barclays Live, Barclays Research

FIGURE 8
TEVA Yield Curves



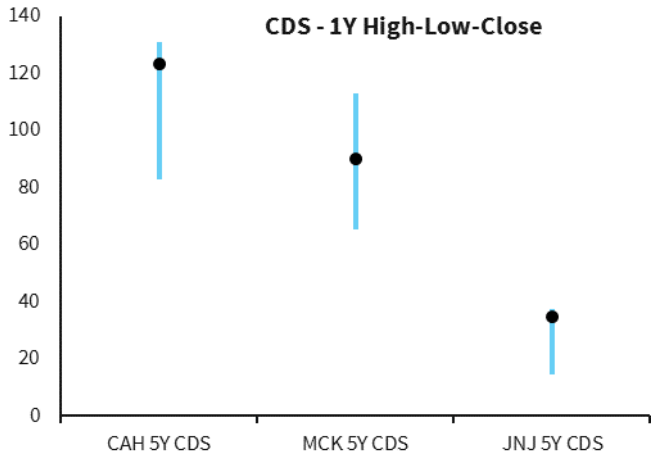
Source: Barclays Live, Barclays Research

FIGURE 9
MNK/ENDP/TEVA Equity Prices



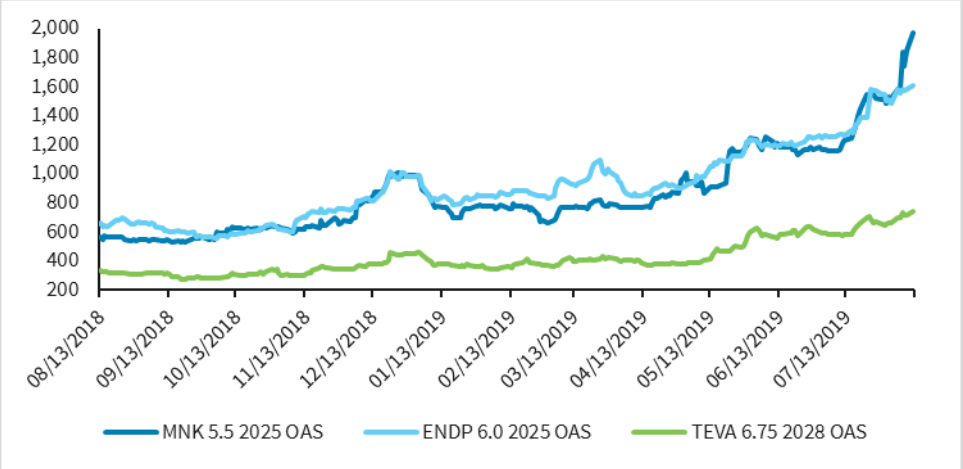
Source: Barclays Live, Barclays Research

FIGURE 10
CAH/MCK/JNJ CDS Spreads



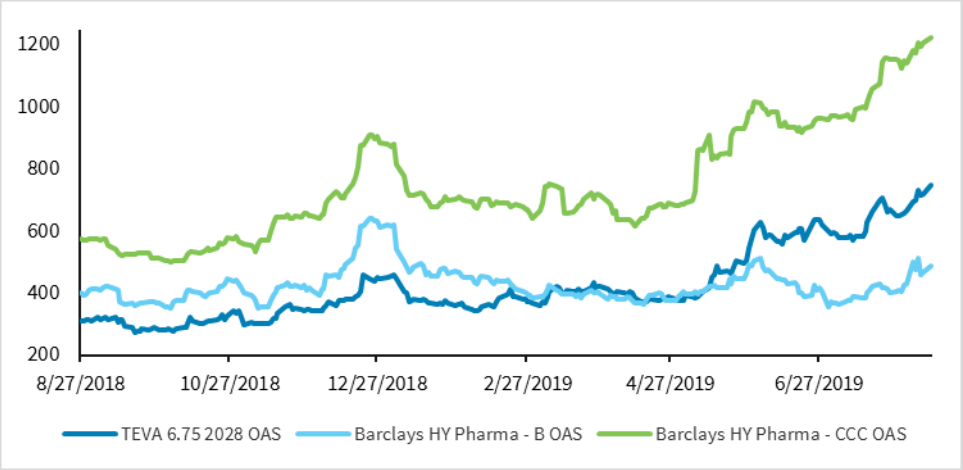
Source: Barclays Live, Barclays Research

FIGURE 11
MNK/ENDP/TEVA Bonds OAS



Source: Barclays Live, Barclays Research

FIGURE 12
TEVA Bonds OAS vs. Barclays HY Pharma Index



Source: Bloomberg, Barclays Live, Barclays Research

Opioid liability summary

Our manufacturer liability estimate is based on a $100bn global settlement, and we assume roughly 46% of the settlement will be allocated to manufacturers (details are below). Our estimate also assumes all parties, both state AGs and Multi-District Litigation (MDL) plaintiffs, settle.

ENDP: Based on our assumptions, we estimate ENDP's liability is $4.4bn. We realize the ARCOS data do not include Opana ER from 2012 to 2017 (Figure 35), but we factor this share into our culpability scores.

TEVA: We estimate TEVA's liability is $6.0bn. Its generic and fentanyl share exceeded ENDP's. While Cephalon paid $425mn as part of a plea agreement, we believe the diversion risk for *fentanyl was high;* it seems as if there was diversion with its product portfolio, especially considering its product portfolio required the use of other long-acting opioids such as Actiq or Fentora. Teva also indemnified Allergan in 2016 at the time of its purchase of Activs in 2016 and again when both parties settled their working capital adjustment.

MNK: We estimate the liability is $4.0bn. Our culpability factor reflects MNK's high script count, which may have led to increased diversion. MNK agreed to pay $35mn (according to the *Washington Post,* in 2017, the US government calculated fines of $2.3bn for nearly 44,000 opioid order violations) after the company failed to report "suspicious orders as 500mn of its pills ended up in Florida between 2008 and 2012 – 66% of all oxycodone sold in the state." We factored these diversion problems into our culpability scores. Furthermore, we believe if J&J's API market share affects the Oklahoma ruling, we must also consider MNK's bulk API for distribution to its customers (*DEA, May 23, 2019*).

Details behind the liability estimates

Estimating a settlement and assigning damages to each defendant is a complex process, and we are certain there are a number of algorithmic scenarios that the Special Masters are evaluating. We, on the other hand, are not experts in algorithms. Therefore, in assessing the potential liability per manufacturer, we utilized the ARCOS (Automation of Reports and Consolidated Orders System) data from the DEA site and from the court's recent release of these data, obtained by the *Washington Post*. We applied certain culpability scores to the data and other parameters to estimate an allocation percentage.

Commentary from Ryan Preclaw and Troy Li

The ARCOS database is maintained by the Drug Enforcement Administration (DEA), which monitors the flow of every single pill of DEA controlled substances from manufacture through distribution channels to end-markets, including hospitals, retail pharmacies, practitioners, and teaching and research institutions. The data were not available to the public until it was recently released as part of the largest civil action in US history, in which drug companies are being sued in federal court by nearly 2,000 cities, towns and counties for their understating the risks of opioids and failing to monitor suspiciously large orders, which caused a flood of opioids to the public.

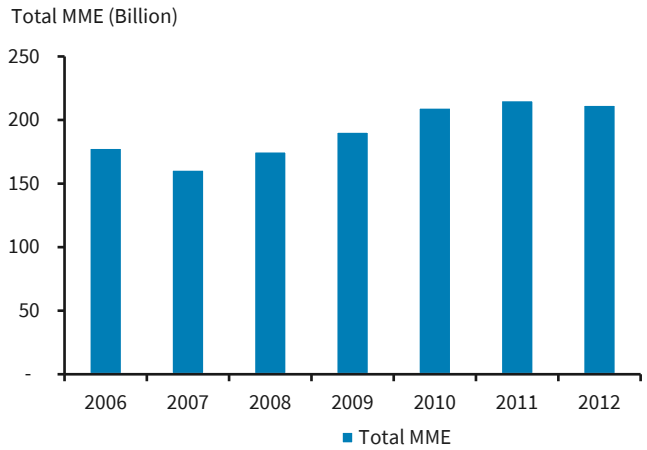
The data have more than 378 million rows of records from 2006 to 2012. Each record has transaction-level opioid script details, including transaction date, buyer and seller's business information, drug name, quantity, labeller, and other relevant information that enables users to calculate a standardize morphine milligram equivalent (MME) for aggregation. For our purpose of understanding liability shares among drug companies, we have cleaned the data by applying certain filters to avoid duplicates and target only records that are relevant to the possible illegal use of opioids. First, our research focuses on sales records only. While we found sales and purchase records in the data, we believe only the former have complete records, as they account for majority of the data. Our next step is to define an end-market so that any intermediary transaction between manufacturers and distribution channels is excluded. To achieve this, we restricted buyer's business types to what we believe are end-consumers such as hospitals, pharmacies and practitioners (and excluded clinics, military and mid-level professionals.). Last, we included only specific measures such as tabs, caps, lozenges, etc., that are likely involved in illegal opioid use (certain forms such as raw powder, syrup and liquid were excluded) and excluded methadone and buprenorphine because while these drugs contain addiction qualities, both are mostly used in clinics and skew the data (Figures 31 contains the two drugs' ARCOS data). A summary of our data cleaning process is listed in Figure 13. With the data cleaned, we manually mapped the labeller in each transaction to a manufacturer and aggregated the data to provide a market share, as defined by MME share, manufacturer, state, measure, and more. While we focused on ENDP, MNK and TEVA, there are roughly 120 unique manufacturers, and not all of them are named in the MDL.

FIGURE 13
Number of records

	Number of Records
Total	378,573,015
Sales only	337,078,556
Buyer type restriction	322,351,758
Drug measure restriction	288,939,714
Drug name restriction	265,631,735

Source: ARCOS, Washington Post, Barclays Research

FIGURE 14
Total MME (billions)



Source: ARCOS, Washington Post, Barclays Research

FIGURE 15
ARCOS Data – By Manufacturer

Ticker	Drug Name	Average MME Conversion Factor	MME	Molecular base weight (g)	Quantity - Package	Quantity - Dosage
AMRX	HYDROCODONE	1.00	7,703,295,891	7,703,296	12,131,200	1,677,830,294
	OXYCODONE	1.50	6,362,607,619	4,241,738	5,199,115	600,907,825
	CODEINE	0.15	5,912,653	39,418	4,169	1,783,525
AMRX Total		**1.09**	**14,071,816,163**	**11,984,452**	**17,334,484**	**2,280,521,644**
ENDP	OXYCODONE	1.50	75,526,261,643	50,350,841	45,824,982	4,966,069,299
	HYDROCODONE	1.00	39,017,217,365	39,017,217	39,077,498	7,801,099,152
	MORPHINE	1.00	24,962,621,394	24,962,621	7,109,020	710,203,713
	OXYMORPHONE	3.00	20,782,376,075	6,927,459	4,124,837	369,257,229
	CODEINE	0.15	2,989,250,564	19,928,336	2,950,128	812,180,431
	MEPERIDINE	0.10	450,586,866	4,505,869	957,192	95,719,200
	FENTANYL	130.00	200,748,017	1,544	366,112	2,052,114
	DIHYDROCODEINE	0.25	48,914,247	195,657	160,500	9,158,599
	HYDROMORPHONE	4.00	6,599,686	1,650	5,963	596,300
ENDP Total		**12.19**	**163,984,575,857**	**145,891,195**	**100,576,232**	**14,766,336,037**
LCI	HYDROMORPHONE	4.00	1,094,025,198	273,506	789,587	78,948,638
	CODEINE	0.15	231,901,507	1,546,010	699,730	69,953,179
	OXYCODONE	1.50	1,370,973	914	2,039	203,900
LCI Total		**1.99**	**1,327,297,678**	**1,820,430**	**1,491,356**	**149,105,717**
MNK	OXYCODONE	1.50	147,270,745,098	98,180,497	107,915,147	12,178,430,000
	HYDROCODONE	1.00	85,067,180,897	85,067,181	98,383,418	20,392,086,553
	MORPHINE	1.00	37,463,608,340	37,463,608	12,562,921	1,258,147,949
	HYDROMORPHONE	4.00	15,795,406,947	3,948,852	11,492,337	1,144,998,365
	FENTANYL	118.00	10,982,598,051	107,417	3,304,061	24,091,935
	CODEINE	0.15	3,938,430,842	26,256,205	5,702,070	1,033,636,115
	MEPERIDINE	0.10	16,652,187	166,522	32,484	3,248,400
MNK Total		**16.96**	**300,534,622,362**	**251,190,281**	**239,392,438**	**36,034,639,318**
MYL	FENTANYL	100.00	124,481,221,737	1,244,812	44,868,285	224,893,764
	OXYCODONE	1.50	2,047,456,660	1,364,971	1,516,810	150,656,605
	MORPHINE	1.00	1,909,432,626	1,909,433	590,241	58,832,100
	HYDROCODONE	1.00	88,151,172	88,151	229,546	21,900,376
	CODEINE	0.15	62,806,712	418,711	181,871	18,096,260
MYL Total		**18.54**	**128,589,068,907**	**5,026,079**	**47,386,753**	**474,379,105**

Source: ARCOS, Washington Post, Barclays Research

FIGURE 14
ARCOS Data – By Manufacturer (continued)

Ticker	Drug Name	Average MME Conversion Factor	MME	Molecular base weight (g)	Quantity - Package	Quantity - Dosage
TEVA	OXYCODONE	1.50	139,222,123,574	92,814,749	56,966,516	6,537,702,149
	HYDROCODONE	1.00	133,966,324,209	133,966,324	75,489,074	20,935,923,693
	FENTANYL	123.79	78,524,220,825	754,479	27,872,621	246,189,640
	MORPHINE	1.00	19,074,692,928	19,074,693	5,833,629	578,194,196
	CODEINE	0.15	7,289,102,182	48,594,013	6,175,889	1,909,716,345
	MEPERIDINE	0.10	460,881,513	4,608,815	900,240	89,973,172
	OXYMORPHONE	3.00	243,560,700	81,187	65,500	6,550,000
	HYDROMORPHONE	4.00	32,944,638	8,236	11,612	1,161,200
TEVA Total		**34.45**	**378,813,850,570**	**299,902,496**	**173,315,081**	**30,305,410,395**
JNJ	FENTANYL	100.00	32,438,512,996	324,385	8,433,482	42,163,757
	TAPENTADOL	0.40	6,160,563,872	15,401,409	2,455,806	202,153,539
	CODEINE	0.15	192,931,068	1,286,207	405,937	42,790,043
	OXYCODONE	1.50	69,081,825	46,055	102,743	10,274,300
	HYDROMORPHONE	4.00	15,042,312	3,761	286,821	286,821
JNJ Total		**39.66**	**38,876,132,072**	**17,061,817**	**11,684,789**	**297,668,460**
P-ALVOGEN	OXYCODONE	1.50	161,053,649	107,369	72,651	11,427,100
P-ALVOGEN Total		**1.50**	**161,053,649**	**107,369**	**72,651**	**11,427,100**
P-PURDUE	OXYCODONE	1.50	143,712,248,214	95,808,165	31,125,397	2,678,388,866
	MORPHINE	1.00	11,915,143,760	11,915,144	3,560,073	355,953,396
	HYDROMORPHONE	4.00	3,516,245,832	879,061	2,843,426	229,427,442
P-PURDUE Total		**1.73**	**159,143,637,806**	**108,602,371**	**37,528,896**	**3,263,769,704**
Others	FENTANYL	106.67	66,144,748,618	661,210	29,870,483	106,137,849
	MORPHINE	1.00	38,198,686,676	38,198,687	23,688,448	1,575,295,286
	OXYCODONE	1.50	29,498,559,644	19,665,706	22,367,698	2,042,840,917
	HYDROCODONE	1.00	12,442,958,427	12,442,958	48,054,934	2,960,354,534
	HYDROMORPHONE	4.00	8,849,610,321	2,212,403	16,628,252	328,119,700
	CODEINE	0.15	1,759,315,791	11,728,771	4,694,271	466,750,452
	OXYMORPHONE	2.96	668,530,247	222,846	296,045	28,835,619
	MEPERIDINE	0.10	446,888,772	4,468,888	2,334,248	52,517,437
	LEVORPHANOL	11.00	128,684,442	11,699	100,143	10,004,499
	DIHYDROCODEINE	0.25	92,044,878	368,180	1,056,423	23,150,673
	TAPENTADOL	0.40	3,816,568	9,541	17,171	154,170
Others Total		**6.73**	**158,233,844,385**	**89,990,889**	**149,108,116**	**7,594,161,136**
Grand Total		**10.06**	**1,343,735,899,449**	**931,577,378**	**777,890,796**	**95,177,418,615**

Source: ARCOS, Washington Post, Barclays Research

FIGURE 15
ARCOS Data – By Manufacturer in Percentage

Ticker	Drug Name	Average MME Conversion Factor	MME (%)	Molecular base weight (%)	Quantity - Package (%)	Quantity - Dosage (%)
AMRX	HYDROCODONE	1.00	0.57%	0.83%	1.56%	1.76%
	OXYCODONE	1.50	0.47%	0.46%	0.67%	0.63%
	CODEINE	0.15	0.00%	0.00%	0.00%	0.00%
AMRX Total		**1.09**	**1.05%**	**1.29%**	**2.23%**	**2.40%**
ENDP	OXYCODONE	1.50	5.62%	5.40%	5.89%	5.22%
	HYDROCODONE	1.00	2.90%	4.19%	5.02%	8.20%
	MORPHINE	1.00	1.86%	2.68%	0.91%	0.75%
	OXYMORPHONE	3.00	1.55%	0.74%	0.53%	0.39%
	CODEINE	0.15	0.22%	2.14%	0.38%	0.85%
	MEPERIDINE	0.10	0.03%	0.48%	0.12%	0.10%
	FENTANYL	130.00	0.01%	0.00%	0.05%	0.00%
	DIHYDROCODEINE	0.25	0.00%	0.02%	0.02%	0.01%
	HYDROMORPHONE	4.00	0.00%	0.00%	0.00%	0.00%
ENDP Total		**12.19**	**12.20%**	**15.66%**	**12.93%**	**15.51%**
LCI	HYDROMORPHONE	4.00	0.08%	0.03%	0.10%	0.08%
	CODEINE	0.15	0.02%	0.17%	0.09%	0.07%
	OXYCODONE	1.50	0.00%	0.00%	0.00%	0.00%
LCI Total		**1.99**	**0.10%**	**0.20%**	**0.19%**	**0.16%**
MNK	OXYCODONE	1.50	10.96%	10.54%	13.87%	12.80%
	HYDROCODONE	1.00	6.33%	9.13%	12.65%	21.43%
	MORPHINE	1.00	2.79%	4.02%	1.61%	1.32%
	HYDROMORPHONE	4.00	1.18%	0.42%	1.48%	1.20%
	FENTANYL	118.00	0.82%	0.01%	0.42%	0.03%
	CODEINE	0.15	0.29%	2.82%	0.73%	1.09%
	MEPERIDINE	0.10	0.00%	0.02%	0.00%	0.00%
MNK Total		**16.96**	**22.37%**	**26.96%**	**30.77%**	**37.86%**
MYL	FENTANYL	100.00	9.26%	0.13%	5.77%	0.24%
	OXYCODONE	1.50	0.15%	0.15%	0.19%	0.16%
	MORPHINE	1.00	0.14%	0.20%	0.08%	0.06%
	HYDROCODONE	1.00	0.01%	0.01%	0.03%	0.02%
	CODEINE	0.15	0.00%	0.04%	0.02%	0.02%
MYL Total		**18.54**	**9.57%**	**0.54%**	**6.09%**	**0.50%**

Source: ARCOS, Washington Post, Barclays Research

FIGURE 16
ARCOS Data – By Manufacturer in Percentage (continued)

Ticker	Drug Name	Average MME Conversion Factor	MME (%)	Molecular base weight (%)	Quantity - Package (%)	Quantity - Dosage (%)
TEVA	OXYCODONE	1.50	10.36%	9.96%	7.32%	6.87%
	HYDROCODONE	1.00	9.97%	14.38%	9.70%	22.00%
	FENTANYL	123.79	5.84%	0.08%	3.58%	0.26%
	MORPHINE	1.00	1.42%	2.05%	0.75%	0.61%
	CODEINE	0.15	0.54%	5.22%	0.79%	2.01%
	MEPERIDINE	0.10	0.03%	0.49%	0.12%	0.09%
	OXYMORPHONE	3.00	0.02%	0.01%	0.01%	0.01%
	HYDROMORPHONE	4.00	0.00%	0.00%	0.00%	0.00%
TEVA Total		**34.45**	**28.19%**	**32.19%**	**22.28%**	**31.84%**
JNJ	FENTANYL	100.00	2.41%	0.03%	1.08%	0.04%
	TAPENTADOL	0.40	0.46%	1.65%	0.32%	0.21%
	CODEINE	0.15	0.01%	0.14%	0.05%	0.04%
	OXYCODONE	1.50	0.01%	0.00%	0.01%	0.01%
	HYDROMORPHONE	4.00	0.00%	0.00%	0.04%	0.00%
JNJ Total		**39.66**	**2.89%**	**1.83%**	**1.50%**	**0.31%**
P-ALVOGEN	OXYCODONE	1.50	0.01%	0.01%	0.01%	0.01%
P-ALVOGEN Total		**1.50**	**0.01%**	**0.01%**	**0.01%**	**0.01%**
P-PURDUE	OXYCODONE	1.50	10.69%	10.28%	4.00%	2.81%
	MORPHINE	1.00	0.89%	1.28%	0.46%	0.37%
	HYDROMORPHONE	4.00	0.26%	0.09%	0.37%	0.24%
P-PURDUE Total		**1.73**	**11.84%**	**11.66%**	**4.82%**	**3.43%**
Others	FENTANYL	106.67	4.92%	0.07%	3.84%	0.11%
	MORPHINE	1.00	2.84%	4.10%	3.05%	1.66%
	OXYCODONE	1.50	2.20%	2.11%	2.88%	2.15%
	HYDROCODONE	1.00	0.93%	1.34%	6.18%	3.11%
	HYDROMORPHONE	4.00	0.66%	0.24%	2.14%	0.34%
	CODEINE	0.15	0.13%	1.26%	0.60%	0.49%
	OXYMORPHONE	2.96	0.05%	0.02%	0.04%	0.03%
	MEPERIDINE	0.10	0.03%	0.48%	0.30%	0.06%
	LEVORPHANOL	11.00	0.01%	0.00%	0.01%	0.01%
	DIHYDROCODEINE	0.25	0.01%	0.04%	0.14%	0.02%
	TAPENTADOL	0.40	0.00%	0.00%	0.00%	0.00%
Others Total		**6.73**	**11.78%**	**9.66%**	**19.17%**	**7.98%**
Grand Total		**10.06**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Source: ARCOS, Washington Post, Barclays Research

FIGURE 17

ARCOS Data – By Drug Type

Type	Drug Name	Average MME Conversion Factor	MME	Molecular base weight (g)	Quantity - Package	Quantity - Dosage
TAB	CODEINE	0.15	15,990,859,166	106,605,724	19,395,448	4,210,393,153
	DIHYDROCODEINE	0.25	115,731,984	462,928	465,193	22,214,516
	FENTANYL	130.00	2,263,444,543	17,411	2,711,230	35,815,894
	HYDROCODONE	1.00	278,156,428,491	278,156,429	271,482,421	53,762,938,572
	HYDROMORPHONE	4.00	25,875,042,470	6,468,761	18,121,030	1,783,465,070
	LEVORPHANOL	11.00	128,684,442	11,699	100,143	10,004,499
	MEPERIDINE	0.10	1,024,112,212	10,241,122	2,197,481	211,492,161
	MORPHINE	1.00	114,170,029,399	114,170,029	41,101,664	4,107,460,835
	OXYCODONE	1.50	539,014,326,840	359,342,885	262,992,458	28,459,624,739
	OXYMORPHONE	2.86	21,691,568,084	7,230,526	4,353,119	404,642,848
	TAPENTADOL	0.40	6,164,380,440	15,410,951	2,472,977	202,307,709
TAB Total		**3.25**	**1,004,594,608,071**	**898,118,463**	**625,393,164**	**93,210,359,994**
PO/PA	FENTANYL	100.00	296,626,715,618	2,966,267	99,402,857	497,557,605
PO/PA Total		**100.00**	**296,626,715,618**	**2,966,267**	**99,402,857**	**497,557,605**
CAP	CODEINE	0.15	478,792,153	3,191,948	1,418,617	144,513,198
	DIHYDROCODEINE	0.25	25,227,142	100,909	751,730	10,094,756
	HYDROCODONE	1.00	128,642,928	128,643	1,883,000	26,256,030
	HYDROMORPHONE	4.00	1,390,219	348	73,396	73,396
	MEPERIDINE	0.10	164,067,497	1,640,675	301,692	29,966,048
	MORPHINE	1.00	18,139,606,823	18,139,607	4,353,235	429,165,805
	OXYCODONE	1.50	4,841,097,494	3,227,398	8,080,705	717,276,222
CAP Total		**0.96**	**23,778,824,256**	**26,429,527**	**16,862,375**	**1,357,345,455**
LLPOP	FENTANYL	130.00	7,594,986,531	58,423	2,314,758	68,990,354
LLPOP Total		**130.00**	**7,594,986,531**	**58,423**	**2,314,758**	**68,990,354**
LOZ	FENTANYL	130.00	4,819,898,947	37,076	1,438,841	43,165,207
LOZ Total		**130.00**	**4,819,898,947**	**37,076**	**1,438,841**	**43,165,207**
VL	FENTANYL	100.00	105,779,029	1,058	193,577	
	HYDROCODONE	1.00	56,529	57	249	
	HYDROMORPHONE	4.00	2,700,329,189	675,082	7,562,323	
	MEPERIDINE	0.10	103,165,199	1,031,652	1,068,214	
	MORPHINE	1.00	1,090,131,982	1,090,132	6,650,987	
	OXYMORPHONE	3.00	60	0	2	
VL Total		**19.30**	**3,999,461,988**	**2,797,981**	**15,475,352**	**0**
AMP	FENTANYL	100.00	1,361,225,582	13,612	8,653,781	
	HYDROMORPHONE	4.00	733,113,056	183,278	6,301,249	
	MEPERIDINE	0.10	83,664,430	836,644	656,777	
	MORPHINE	1.00	124,417,520	124,418	1,238,446	
	OXYCODONE	1.50	16,084,555	10,723	19,935	
	OXYMORPHONE	3.00	2,898,879	966	133,261	
AMP Total		**8.39**	**2,321,404,022**	**1,169,642**	**17,003,449**	**0**
Grand Total		**10.16**	**1,343,735,899,431**	**931,577,378**	**777,890,796**	**95,177,418,615**

Source: ARCOS, Washington Post, Barclays Research

FIGURE 18

ARCOS Data – By Drug Type in Percentage

Type	Drug Name	Average MME Conversion Factor	MME (%)	Molecular base weight (%)	Quantity - Package (%)	Quantity - Dosage (%)
TAB	CODEINE	0.15	1.19%	11.44%	2.49%	4.42%
	DIHYDROCODEINE	0.25	0.01%	0.05%	0.06%	0.02%
	FENTANYL	130.00	0.17%	0.00%	0.35%	0.04%
	HYDROCODONE	1.00	20.70%	29.86%	34.90%	56.49%
	HYDROMORPHONE	4.00	1.93%	0.69%	2.33%	1.87%
	LEVORPHANOL	11.00	0.01%	0.00%	0.01%	0.01%
	MEPERIDINE	0.10	0.08%	1.10%	0.28%	0.22%
	MORPHINE	1.00	8.50%	12.26%	5.28%	4.32%
	OXYCODONE	1.50	40.11%	38.57%	33.81%	29.90%
	OXYMORPHONE	2.86	1.61%	0.78%	0.56%	0.43%
	TAPENTADOL	0.40	0.46%	1.65%	0.32%	0.21%
TAB Total		**3.25**	**74.76%**	**96.41%**	**80.40%**	**97.93%**
PO/PA	FENTANYL	100.00	22.07%	0.32%	12.78%	0.52%
PO/PA Total		**100.00**	**22.07%**	**0.32%**	**12.78%**	**0.52%**
CAP	CODEINE	0.15	0.04%	0.34%	0.18%	0.15%
	DIHYDROCODEINE	0.25	0.00%	0.01%	0.10%	0.01%
	HYDROCODONE	1.00	0.01%	0.01%	0.24%	0.03%
	HYDROMORPHONE	4.00	0.00%	0.00%	0.01%	0.00%
	MEPERIDINE	0.10	0.01%	0.18%	0.04%	0.03%
	MORPHINE	1.00	1.35%	1.95%	0.56%	0.45%
	OXYCODONE	1.50	0.36%	0.35%	1.04%	0.75%
CAP Total		**0.96**	**1.77%**	**2.84%**	**2.17%**	**1.43%**
LLPOP	FENTANYL	130.00	0.57%	0.01%	0.30%	0.07%
LLPOP Total		**130.00**	**0.57%**	**0.01%**	**0.30%**	**0.07%**
LOZ	FENTANYL	130.00	0.36%	0.00%	0.18%	0.05%
LOZ Total		**130.00**	**0.36%**	**0.00%**	**0.18%**	**0.05%**
VL	FENTANYL	100.00	0.01%	0.00%	0.02%	
	HYDROCODONE	1.00	0.00%	0.00%	0.00%	
	HYDROMORPHONE	4.00	0.20%	0.07%	0.97%	
	MEPERIDINE	0.10	0.01%	0.11%	0.14%	
	MORPHINE	1.00	0.08%	0.12%	0.86%	
	OXYMORPHONE	3.00	0.00%	0.00%	0.00%	
VL Total		**19.30**	**0.30%**	**0.30%**	**1.99%**	**0.00%**
AMP	FENTANYL	100.00	0.10%	0.00%	1.11%	
	HYDROMORPHONE	4.00	0.05%	0.02%	0.81%	
	MEPERIDINE	0.10	0.01%	0.09%	0.08%	
	MORPHINE	1.00	0.01%	0.01%	0.16%	
	OXYCODONE	1.50	0.00%	0.00%	0.00%	
	OXYMORPHONE	3.00	0.00%	0.00%	0.02%	
AMP Total		**8.39**	**0.17%**	**0.13%**	**2.19%**	**0.00%**
Grand Total		**10.16**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Source: ARCOS, Washington Post, Barclays Research

FIGURE 19

ARCOS Data – By Counterparty in Percentage

Ticker	Counterparty	Distributor	Pharmacy	Others	Grand Total
AMRX	MCK	0.15%			0.15%
	CAH	0.23%			0.23%
	ABC	0.10%			0.10%
	ANDA (TEVA)	0.04%			0.04%
	CVS		0.11%		0.11%
	KR		0.01%		0.01%
	RAD		0.05%		0.05%
	WMT		0.14%		0.14%
	Others			0.22%	0.22%
AMRX Total		**0.52%**	**0.31%**	**0.22%**	**1.05%**
ENDP	MCK	3.66%			3.66%
	CAH	2.34%			2.34%
	ABC	1.81%			1.81%
	ANDA (TEVA)	0.22%			0.22%
	CVS		0.65%		0.65%
	KR		0.15%		0.15%
	RAD		0.29%		0.29%
	WBA		0.32%		0.32%
	WMT		0.47%		0.47%
	Others			2.29%	2.29%
ENDP Total		**8.03%**	**1.88%**	**2.29%**	**12.20%**
LCI	MCK	0.04%			0.04%
	CAH	0.01%			0.01%
	ABC	0.02%			0.02%
	ANDA (TEVA)	0.01%			0.01%
	CVS		0.00%		0.00%
	RAD		0.00%		0.00%
	WBA		0.00%		0.00%
	Others			0.02%	0.02%
LCI Total		**0.07%**	**0.01%**	**0.02%**	**0.10%**
MNK	MCK	6.10%			6.10%
	CAH	4.91%			4.91%
	ABC	3.29%			3.29%
	ANDA (TEVA)	0.14%			0.14%
	CVS		1.15%		1.15%
	KR		0.23%		0.23%
	RAD		0.53%		0.53%
	WBA		1.18%		1.18%
	WMT		1.85%		1.85%
	Others			2.98%	2.98%
MNK Total		**14.44%**	**4.94%**	**2.98%**	**22.37%**

Source: ARCOS, Washington Post, Barclays Research

FIGURE 19

ARCOS Data – By Counterparty in Percentage (continued)

Ticker	Counterparty	Distributor	Pharmacy	Others	Grand Total
MYL	MCK	2.74%			2.74%
	CAH	3.34%			3.34%
	ABC	1.42%			1.42%
	ANDA (TEVA)	0.02%			0.02%
	RAD		0.06%		0.06%
	WBA		0.86%		0.86%
	WMT		0.04%		0.04%
	Others			1.08%	1.08%
MYL Total		**7.52%**	**0.97%**	**1.08%**	**9.57%**
TEVA	MCK	4.58%			4.58%
	CAH	3.64%			3.64%
	ABC	4.07%			4.07%
	ANDA (TEVA)	0.80%			0.80%
	CVS		0.18%		0.18%
	KR		0.21%		0.21%
	RAD		0.23%		0.23%
	WBA		8.21%		8.21%
	WMT		0.74%		0.74%
	Others			5.53%	5.53%
TEVA Total		**13.10%**	**9.57%**	**5.53%**	**28.19%**
P-ALVOGEN	MCK	0.01%			0.01%
	CAH	0.00%			0.00%
	ABC	0.00%			0.00%
	Others			0.00%	0.00%
P-ALVOGEN Total		**0.01%**		**0.00%**	**0.01%**
P-PURDUE	MCK	3.62%			3.62%
	CAH	3.12%			3.12%
	ABC	2.35%			2.35%
	ANDA (TEVA)	0.07%			0.07%
	RAD		0.01%		0.01%
	WBA		1.49%		1.49%
	WMT		0.14%		0.14%
	Others			1.04%	1.04%
P-PURDUE Total		**9.16%**	**1.65%**	**1.04%**	**11.84%**
Others	MCK	4.17%			4.17%
	CAH	3.28%			3.28%
	ABC	3.04%			3.04%
	ANDA (TEVA)	0.11%			0.11%
	CVS		0.01%		0.01%
	KR		0.01%		0.01%
	RAD		0.04%		0.04%
	WBA		1.19%		1.19%
	WMT		0.46%		0.46%
	Others			2.36%	2.36%
Others Total		**10.60%**	**1.71%**	**2.36%**	**14.67%**
Grand Total		**63.45%**	**21.03%**	**15.52%**	**100.00%**

Source: ARCOS, Washington Post, Barclays Research

Nationwide abatement costs

The purpose of an abatement estimate is to "reduce or eliminate the nuisance prospectively." Most of the abatement plans we have reviewed focus on prospective plans to address the nuisance over a 10- to 30-year period, and areas of prevention include addressing harm, opioid treatment and law enforcement.

The courts will ultimately use expert estimates to determine the abatement cost. In testimony, Caleb Alexander (a practicing general internist and Professor of Epidemiology and Medicine at Johns Hopkins with experience in pharmacoepidemiologist), estimated abatement costs at $452.9bn. He later added another $30.4bn, for a total of $483bn (Figure 22). Altrium projects the additional cost to address the opioid crisis at $500bn from 2018 to 2020.

Recently, a number of depositions were released that contained estimated costs associated with the opioid epidemic. In a 2013 presentation, McKesson (according to Case No 1:18-op-45090, County of Summit, OH, et al. v. Purdue Pharma) stated the opioid problem was a "national epidemic" and that the economic effect on the US is more than $57bn per year. AmerisourceBergen estimated the cost at $55bn per year, H.D. Smith believes the crisis is a public nuisance and estimated a cost of $70bn per year, Henry Schein estimated that "21% to 29% of patients prescribed opioids for chronic pain misuse them," Walgreens highlighted that six in 10 overdoses involved opioids, and US pharmacies dispensed more than 650,000 opioid prescriptions per day (not MME adjusted) and estimated the societal cost was nearly $56bn ($25bn in healthcare costs and $5.1bn in criminal justice costs). A Mallinckrodt presentation highlights that the "diagnosed opioid abuse increased 2-fold from 2005 to 2010" and identifies "1.77mn abusers or drug dependent individuals in 2011." In a graphic in *Time* magazine (May 5, 1997), MNK's methadone training program noted that opioids were a "large and growing problem," with opioids accounting for 83% of the 6.3mn Americans needing treatment. Kathe Sackler noted in her deposition that there is "too much product being out there beyond the needs of patients." Teva noted the opioid crisis is a challenge to public health and that "abuse and misuse has increased…and poses a serious public health issue." Teva also estimate societal costs of $61.5bn. CEO Paul Campanelli of ENDP noted in his deposition that there is an "opioid abuse epidemic."

Analysis of the abatement costs

Per the report and recommendation (R&R) of the magistrate judge, there were thirteen cost areas that were due to personal injury: losses from diverting costs to other public services to address opioid epidemic; healthcare and medical care and other treatments to address opioid-related addiction; ER treatments; to police and provide naloxone for first responders; emergency responses; mental-health services and rehab services; providing medical help to newborns with opioid-related conditions; controlling the illicit market; other criminal matters; care for children whose parents are suffering from opioid-related conditions; loss of tax revenue; loss from lower property values in neighborhoods affected by opioids; and loss from lower property values due to decreased investment.

These costs are associated with the public nuisance argument. The question is whether the defendants can claim that they did not have control over the public nuisance since the pills may not have been in their control when patients became addicted and more importantly, that they did not create or directly supply the secondary market for opioids. Therefore, the abatement cost may not fully account for this lack of control. However, the plaintiffs are attempting to prove that the oversupply of opioids was intentional and that the manufacturers were fully aware of the harm. They further argue that the defendants' diversion activities proved their intent to oversaturate the market and that this could spill over into the secondary market, fueling sales.

Another way to categorize the costs is dividing them into health care, criminal justice, lost productivity and costs associated with premature death (lost earnings, etc.). These are split

between a non-fatal component (roughly 75%) and a fatal component (roughly 25%), with the latter consisting mostly lifetime costs that must be discounted. Determining the value of a statistical life is based on a number of assumptions, most of which are well documented in various government policies.

According to the MDL McGuire deposition, estimating costs is difficult, as there are no established market prices on the outputs. Doing so requires evaluating ER visits (using medical claims data by payor), inpatient and outpatient utilization and costs by payor (evaluated using medical claims data to identify ICD codes from poisoning to dependence to abuse), and prescription drug utilization and comorbidities (hepatitis, nonopioid poisoning, cancer, pain, HIV, mental illness, etc.). In certain studies, the ratio of cost per patient for abusers versus non-abusers ranged from 7-1 to 9-1, with inpatient costs accounting for the largest percentage. Certain long-term indirect health care costs that may arise from disabilities and mental health disorders also have to be considered.

As for criminal justice costs (police protection, legal and adjudication, incarceration costs and loss of property), based on our understanding, the data in the National Incident-Based Reporting System (NIBRS) detail criminal offenses by category, and the costs for drug crimes may need to be multiplied by the number of opioid cases. A majority of the studies utilize an apportionment method to estimate criminal justice costs.

Estimating lost productivity costs involves calculating missed days of work and lost wages and disability costs. The cost from reduced job productivity can be derived through various methods; an approach developed by Ron Goetzel (“Health, Absence, Disability, and Presenteeism Cost Estimates of Certain Physical and Mental Health Conditions Affecting U.S. Employees”) quantifies absence and on-the-job productivity loss to determine the economic burden from various illnesses. The study found that most “presenteeism” costs were higher than medical costs, but also noted the importance of standardization in calculating them.

FIGURE 20
Caleb Alexander's abatement estimates

	Scenario A	Scenario B	Scenario C	Scenario D
all in $bn	**(1)**	**(2)**	**(3)**	**(4)**
Medication Assisted Treatment	169.1	72.9	173.0	164.9
Criminal Justice Interventions	41.7	6.9	7.0	6.4
Mass Media Campaign	5.7	5.7	5.7	5.7
Naloxone	9.3	8.6	8.5	7.8
Adolescent Interventions	20.4	21.3	20.4	15.1
Academic Detailing	3.9	3.9	3.9	3.9
Pregnant Women/Neonates	10.7	11.2	10.7	7.9
Foster Care Interventions	37.5	35.6	37.6	20.7
Hepatitis C/HIV interventions	32.5	23.8	23.9	20.9
Drug Disposal Program	11.1	11.1	11.1	11.1
Surveillance	2.2	2.2	2.2	2.2
Harm Reduction Interventions	38.1	7.7	7.7	7.0
PDMPs	0.7	0.7	0.7	0.7
Research	13.0	13.0	13.0	13.0
Law Enforcement	57.0	57.2	57.2	57.2
Total	**452.9**	**281.8**	**382.6**	**344.5**

Note: (1) Using baseline trend ratios from April 3, 2019. The figures reflect the change on populations for 10 years relative to 2018. (2) Reflects abatement estimates based on updated views on model (no trend ratios, no increased uptake). (3) Similar to Scenario A but does not include updates on redress models from April 17, 2019. (4) Uses trend ratios to reflect interventions. Source: MDL 2804, Bloomberg, Barclays Research

Determining the settlement amount

Our base estimate utilizes Caleb Alexander's $483bn abatement (future harm) estimate. If we assume J&J settles in Oklahoma for $1bn, $5bn or $10bn, the implied global settlement amount (based on the allocation map on opioidsnegotiationclass.info) is $42bn, $210bn and $420bn. Determining a settlement amount on these abatement costs is more of an art than science. We believe the costs will be higher today than in the out years. In a *60 Minutes* interview, one of the lead attorneys in the opioid case, Mike Moore, stated the settlement "may be $100bn." In a Clarion Ledger article (from *January 26, 2018*), Moore noted the cost to treat opioids will range from $50bn to $100bn and argued that drug makers should pay. This settlement estimate amounts to roughly 20% of the abatement costs. We also assume that the settlement is a global one involving the MDL plaintiffs and state AGs.

Breaking down cost between manufacturers, distributors and retailers

We allocate the settlement across manufacturers, distributors and retailers/other based on several factors. We weight the culpability based on three main factors: the ability to pay (based on financial ratios), blameworthiness and supply chain. With regards to the first, we analyzed revenue multiples, EBITDA multiples, FCF multiples, liquidity ratios, the ability to raise liquidity and the DOJ sentencing guidelines. We did not forecast (as we perhaps should) DCF (leveraged and unleveraged) for each company over the next 20-30 years to review revenue and margin trends and stress how this may affect leveraged and unleveraged FCF and their ability to pay these liabilities. We allocated a score to each ratio, with greater weight placed on liquidity-based ones, and then calculated a consolidated

culpability factor weighted by market cap. We realize J&J and WMT skew the factors, but both are just as important. Second, we assigned culpability scores for blameworthiness and supply chain positioning by group, placing more weight on manufacturers; based on most of the depositions and filings, the focus has been on manufacturers and distributors. Finally, we weighted each of the factors, with ability to pay representing 20%, blameworthiness 75% and supply chain 5%. These factors are our estimates, but the higher weight on blameworthiness represents our view that the plaintiffs have spent a considerable amount of time on harm, supply chain and culpability within the supply chain. The ability to pay is important, but we do not allocate a high of a weighting in the group allocation. Based on these factors, we estimate manufacturers will be responsible for 46% of the settlement, distributors 30% and retailers/other 24%. Recently, the distributors (ABC, MCK, CAH) attempted to settle with the state AGs for $10bn. The National Association of AGs countered with $45bn to cover costs.

FIGURE 21

Settlement breakdown by defendants

		Settlement breakdown by defendant group		
Culpability factors	**Weights**	**Manufacturers**	**Distributors**	**Retailers/Other**
Ability to pay	20%	7%	6%	6%
Blameworthiness	75%	35%	22%	18%
Supply Chain	5%	3%	2%	1%
	100%			
Estimated Settlement Allocation		46%	30%	24%
Dollar Allocation ($bn) - based on average		**44**	**29**	**24**

Source: ARCOS data (Washington Post, SLCG.com), Barclays Research

FIGURE 22

Settlement breakdown by defendants

Estimated total settlement ($bn)	**96.6**	<reflects 20% of MDL abatement estimate of $483mn>
Estimated manufacturer allotment	45.5%	

		MNK	ENDP	PURDUE	TEVA	OTHER (1)
Number of companies		**1**	**1**	**1**	**1**	**118**
Allocation of Manufacturer Settlement		9%	10%	23%	14%	44%
Opioid Liability pre insurance ($bn)		**4.0**	**4.4**	**10.1**	**6.0**	**19.4**
Opioid Liability post insurance ($bn)		**3.2**	**3.6**	**8.1**	**4.8**	**15.5**
	Splits	**Culpability Weights**				
Marketing	30%	2.3%	4.0%	10.1%	3.0%	10.6%
Salesforce	5%	0.5%	0.9%	1.0%	0.5%	2.2%
Branded market share based on MME (est)	10%	1.0%	1.1%	3.9%	2.3%	0.0%
Generic market share based on MME (est)	5%	1.3%	0.6%	0.1%	1.5%	0.0%
Ability to pay	40%	3.1%	2.8%	4.1%	5.9%	24.1%
OUD	10%	0.9%	0.6%	3.9%	0.5%	4.0%
Total	**100%**	**9.1%**	**10.1%**	**23.0%**	**13.7%**	**44.0%**

(1) Includes J&J and MYL. We estimate J&J's liability at nearly $12bn. Not all manufacturers in Other are named defendants.

Source: ARCOS data (Washington Post, SLCG.com), Barclays Research

We are basing our "calculator" on a variety of culpability factors. While market share is important, we do not believe it is the sole driver. The main factors in our final culpability score are marketing and salesforce, opioid abuse disorder (driven by MME to pill count and MME weightings to drugs more potent than morphine), ability to pay (tied to financial ratios) and market share (MME). Our weightings are: 30% marketing, 5% salesforce, 15% market share, 40% ability to pay and 10% OUD. We lumped all the "other" manufacturers into other and estimate two of the manufacturers in "Other" represent 85% of the $19bn, which represents the amount that we allocated to other manufacturers based on our culpability scores.

We place greater weight on marketing over salesforce, as the plaintiff attorneys have focused on how manufacturing defendants' marketing tactics increased diversion and propagated the opioid crisis. Purdue had a smaller salesforce, but allocated significant dollars to marketing. We do not distinguish between generics and branded manufacturers. Despite the DEA quotas, the manufacturers (and distributors) have a responsibility in assessing diversion rates and alerting the DEA of suspicious orders. However, the crisis continued for decades, and the harm multiplied during this period, most of which may have been driven by the egregious generic script counts. Therefore, we believe the generic manufacturers' culpability is high and near branded levels. In response to the defendants' partial summary judgment request, the plaintiffs claim the generic manufacturers did not "promote the safety and efficacy of their medicines" and that generic defendants failed to warn of the potential harm. In certain depositions, it seems as if sales managers were selling generic pharmaceuticals. In the deposition of Steven Becker, a former employee of MNK, he stated that he used marketing materials on generic controlled substances when meeting with customers and would investigate (with the customer) prices paid for competitor products, and the marketing materials were distributed at trade conventions (CAH) and presented to pharmacies for buy-ins.

Opioid-specific marketing is difficult to assess through company financials; however, the MDL filings provide with some insight. In 2014, the defendants spent $168mn on marketing branded opioids to doctors. $108mn was spent by Purdue, $34mn by Janssen, $13mn Cephalon, $10mn by Endo and $2mn by Actavis. When Cephalon launched Fentora in 2007, it spent $27mn on marketing. Endo spent nearly $8mn when it launched a reformulated version of Opana ER in 2012. Manufacturer defendants also spent nearly $15mn on advertising in medical journals in 2011: $8.3mn Purdue, $4.9mn Janssen and $1.1mn Endo.

We estimate market share by calculating MME by drug, which evens the playing field. Ability to pay is based on financial ratios we used in calculating culpability by group (manufacturers, distributors and retailers/other); we include asset value, which accounts for Purdue's assets that may have been placed in trusts. We place greater weight on ability to pay, considering it may be a major factor for plaintiff (fee-earning) attorneys.

Data shortcomings

- The data range from 2006 to 2012. Since 2012, new drugs have been approved, such as Purdue's Hysingla ER (hydrocodone bitrate) and Mallinckrodt's Xartemis (oxycodone, hydrochloride and acetaminophen).
- A number of the "other" manufacturers are not named defendants. Included in that group is J&J and Mylan.
- The mappings did not adjust for Teva's acquisition of Actavis, which we had to update manually.

Legal background

MDL review

The opioid MDL 2804 was created in December 2017 and assigned to Judge Dan Polster. In April 2018, the Department of Justice requested to participate in the MDL. The plaintiffs include cities, municipalities, tribes and medical institutions, while the defendants include manufacturers, distributors, physicians and pharmacies. The primary distributors are Teva, Endo, Mallinckrodt, J&J, Purdue Pharma, Alvogen, Abbott Labs, Assertio Therapeutics, King Pharmaceuticals, UCB SA, West-Ward Pharmaceuticals, ICU Medical Inc, Amneal and Pfizer. The primary distributors are AmerisourceBergen, McKesson, Cardinal Health, Anda Pharma (Teva), Henry Schein and The Harvard Drug Group. Pharmacies include Rite Aid, CVS, Walgreens, Wal-Mart, Albertsons, Costco, Express Scripts and Kroger. A number of states filed *amicus curiae* briefs, including Arizona, Arkansas, New York, Tennessee, Texas and Ohio.

There are a number of individual state cases. As of now, Nebraska and Michigan have not initiated separate lawsuits. There were roughly 20 state cases where ENDP is a named defendant, 12 states (including Oklahoma) where JNJ is a named defendant and about 10 states naming MNK.

High-yield named defendants

- **Endo:** Endo Health Solutions (EHSI), EPI, Par Pharmaceutical, Inc (PPI), Endo Pharmaceuticals Inc (EPI), Par Pharmaceutical Companies, Inc (PPCI), Endo Generics Holdings, Inc. (EGHI), Vintage Pharmaceuticals, LLC, Generics Bidco I, LLC and DAVA Pharmaceuticals, LLC; Qualitest Pharmaceuticals; Endo International PLC;

- **Purdue:** Purdue Pharma L.P., Purdue Pharma Inc., Purdue Frederick Company; Purdue Products L.P.; Rhodes Pharmaceuticals, L.P.; Estate of Mortimer Sackler; Dr. Richard Sackler; Rhodes Technologies, Inc.; Purdue Pharma Manufacturing, Inc.; P.F. Laboratories, Inc.; Ilene Sackler Lefcourt; Judy Lewent; Mark Timmey; Cecil Pickett; Beverly Sackler; David Sackler; Johnathan Sackler; Kathe Sackler; Mortimer D.A. Sackler; Theresa Sackler; Rhodes Pharmaceuticals, Inc.; Rhodes Technology; Rhodes Technology, Inc.; Trust for the Benefit of Members of the Raymond Sackler Family; Pharmaceutical Research Associates, Inc.; PLP Associates Holdings L.P.;

- **Teva:** Teva Pharmaceuticals USA, Inc., Cephalon, Watson Laboratories, Inc., Teva Pharmaceutical Industries Ltd., Teva Biopharmaceuticals USA, Inc.; Actavis Elizabeth, LLC; Actavis Laboratories FL, Inc.; Actavis Laboratories UT, Inc.; Actavis Mid Atlantic LLC; Actavis South Atlantic LLC; Actavis Totowa LLC; Anda, Inc.; Barr Laboratories, Inc.; Actavis Laboratories NY Inc.; Anda Pharmaceuticals Inc

- **Mallinckrodt:** Mallinckrodt LLC, Mallinckrodt PLC; Mallinckrodt Brand Pharmaceuticals, Inc; SpecGX LLC; Purchased Roxicodone from Xanodyne Pharmaceuticals; Mallinckrodt Enterprises Holdings, Inc.; Mallinckrodt Enterprises LLC;

- **Amneal:** Amneal Pharmaceuticals of New York, LLC; Amneal Pharmaceuticals, Inc.; Amneal Pharmaceuticals, LLC; Impax Laboratories, Inc.; Amneal Pharmaceuticals, Inc.; Impax Generics;

Timeline

Non-MDL Opioid Case Timeline

- Mid-to-late August 2019: Oklahoma state decision v JNJ.

MDL Timeline

- Summary judgment motions: Oppositions were due July 31, 2019, with replies due on August 16, 2019.

- Daubert motions (whether expert testimony is admissable): Oppositions were filed by July 31, 2019, with replies filed no later than August 16, 2019.
- Dauburt and dispositive motions hearings: To be held September 5, 2019, if necessary.
- Motions in limine (to dismiss testimony, decided by the judge): Filed no later than September 25, 2019. Oppositions filed no later than October 7, 2019. and replies no later than October 14, 2019.
- Final pretrial hearing: October 15, 2019.
- First bellwether trial (Track One): October 21, 2019.
- On August 5, the defendants filed a motion requesting additional time. the MDL noted that Summit and Cahuyga counties are seeking $8bn in damages.

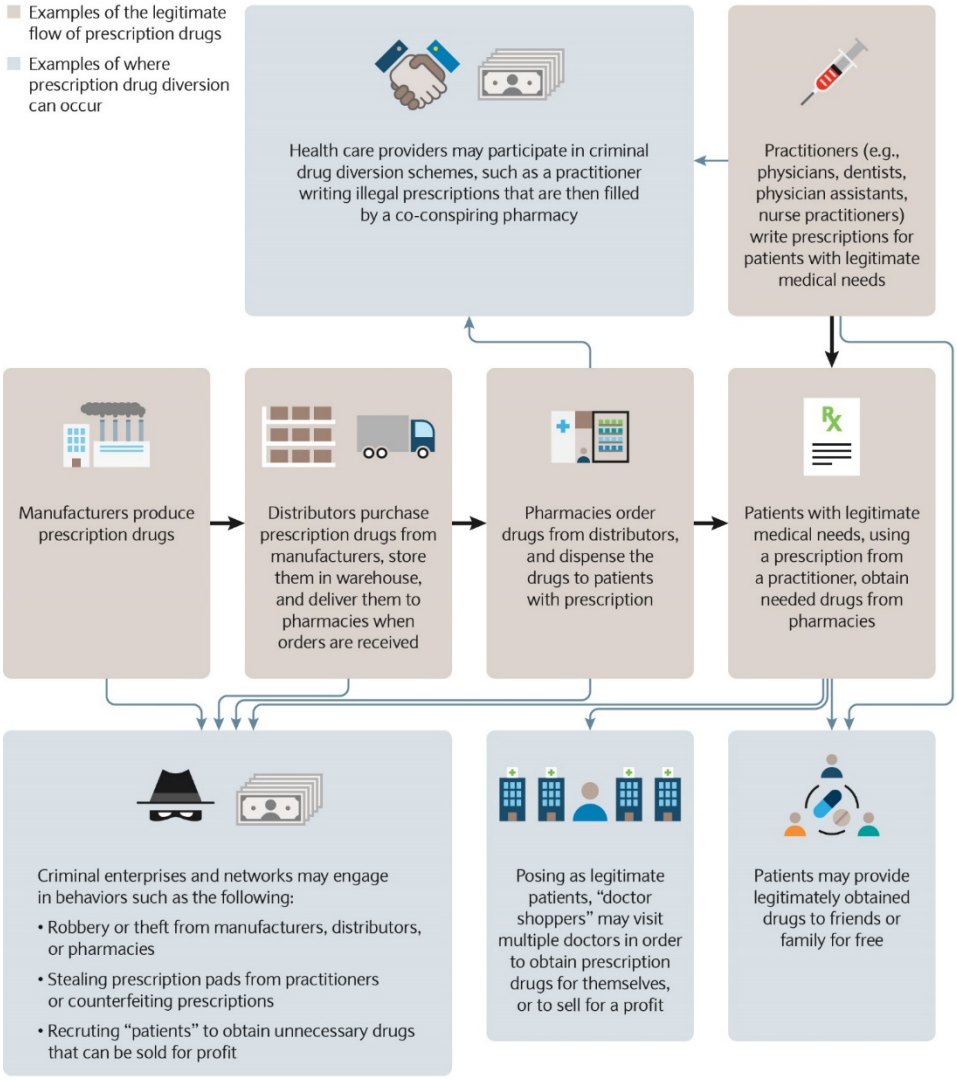
Track One Case (the first trial for MDL 2804)

Judge Polster chose three Ohio cases for Track One: County of Summit, OH v. Purdue Pharma L.P.; The County of Cuyahoga v. Purdue Pharma L.P.; and City of Cleveland v AmerisourceBergen Drug Corp. Other cases chosen for future bellwether trials are from West Virginia, Michigan, Illinois, Florida and Alabama. Since Track One does not include retail pharmacies, the judge chose two West Virginia cases (The City of Huntington v AmerisourceBergen Drug Corp et. al and Cabell County Commission v. AmerisourceBergen Drug Cor, et. Al.) for the next track. The third track may include cases from Alabama; Monroe County, FL; Michigan County, FL; Broward County, FL and the city of Chicago. There is also a Tribal Track: The Muscogee (Creek) Nation v Purdue Pharma and The Blackfeet Tribe of the Blackfeet Indian Reservation v AmerisourceBergen

Allegations

Before reviewing the allegations, we believe it is important to follow the supply chain path. First, the pills are manufactured and packaged. Then, they are sent to distributors, which supply pharmacies with the opioids, which are eventually dispensed to consumers. Practitioners, PBMs, payors and hospitals have had an indirect role in the opioid crisis. Hospitals are not as aggressively targeted for diversion, but based on numerous articles and studies, it does exist within hospitals. The FDA and DEA are also involved, with the FDA approving drugs and marketing plans and DEA setting quotas and providing oversight on suspicious orders (see *final order* for 2019).

FIGURE 23
Diversion



Source: GAO.gov, Barclays Research

Liability Theories

In a December 19, 2018 filing, Judge Polster denied the defendants' motion to dismiss certain liability theories. He described the epidemic as a man-made plague, "twenty years in the making" and concluded, "While these allegations do not fit neatly into the legal theories chosen by the Plaintiffs, they fit nevertheless. Whether the Plaintiffs can prove any of these allegations remains to be seen, but this Court holds that they will have the opportunity."

The plaintiffs believe the named manufacturers precipitated the crisis by exaggerating the benefits of opioids under false premises and deceptive marketing practices. They further argue that the defendants manipulated the pharma supply chain through chargebacks and not designing and operating systems with adequate controls that could have prevented opioid diversion. Filings claim the manufacturer defendants "engaged in a scheme to boost sales for their prescription opioid products by falsely promoting their highly dangerous products for the use of chronic pain and knowingly, recklessly and negligently denying or

trivializing the risk of addiction." The plaintiffs claim the named distributors did not adhere to their "statutory obligations" defined under the 1970 Controlled Substance Act.

These schemes involved using key opinion leaders to deliver favorable speeches or write articles; leveraging continuing medical education programs; paying marketing groups (depositions highlight how certain non-for-profit groups received grants from manufacturers such as Cephalon) such as the American Pain Foundation, the Pain Care Forum or internally created organizations such as C.A.R.E.S Alliance (formed by MNK) to "disseminate" false information; and utilizing non-branded ads (not regulated by FDA) to promote opioids and "falsely promise" relief from pain "with no harmful side-effects" (City of New Haven v Purdue, et al). The plaintiffs further claim defendants created a population of addicted patients and profited from harming them, while the monetary responsibility was borne by municipalities to fund public health and social initiatives, policing and other criminal justice related activities, addiction treatment cents and other areas.

Physicians have been under much scrutiny; however, several documents claim they were used to formulate "patient demand for health care" but are viewed as "imperfect agents" (providers that maximize profits for themselves at the harm of patient's interests). In many instances, physicians were influenced by drug companies and their promotional activity. The defendants have claimed that the epidemic was "the result of bad patients who manipulated doctors"; the plaintiffs counter that those who unlawfully obtained opioids are a "small minority." From the Summit County cases, 60% of opioids that were abused were prescribed through physicians. A citizen petition was filed in 2012 by the Physicians for Responsible Opioid Prescribing to push for changes to opioid labels to limit doses. The group claims that chronic opioid use is not evidenced-based treatment for chronic non-cancer pain. However, many clinicians thought otherwise, which led to over- and high-dose prescribing.

Primary liability theory: Public nuisance

We believe the plaintiffs will focus on the theory of public nuisance: that the defendants' actions reflected misleading and bad conduct, rather than that the epidemic was caused by a particular product. The cost framework on public nuisance is complicated. The concept is "an unreasonable interference with a right common to the general public." Whether the theory is a legitimate claim must be determined if it existed due to the shipment of opioid products into various communities and whether these products led to harm and increased costs. Therefore, the plaintiffs must prove that the defendants controlled the oversupply and over-marketing. The plaintiffs claim the defendants "maintained an absolute public nuisance through their ongoing conduct of marketing, distributing and selling opioids" that eventually led to addiction and the diversion of opioids into the secondary (mostly illegal) markets. The defendants are claiming that addiction was not due to their direct actions and they did not have control once the pills left their facility. As possible precedents, in Cincinnati v Beretta (*decision*), the plaintiffs did not win on the public nuisance claim, as the judge "refused to extend the law of public nuisance arising from the defendants' conduct in designing, marketing and distributing guns" as "a defective design or construction or lack of signage constitutes a nuisance." In City of Chicago v Beretta, the judge noted that the "defendants' lack of control over the firearms at the time of injury is related to their argument that their conduct was so far removed from the eventual criminal acts that, as a matter of policy, it would not be appropriate to hold them legally responsible."

Another liability theories is RICO, claiming that the marketing defendants "conducted an association-in-fact enterprise to unlawfully increase profits and revenues from the continued prescription use of opioids for long-term chronic pain"; supply chain defendants created an "association-in-fact enterprise" to increase quotas and profit from higher opioid sales; and the manufacturers used front groups to push for the benefits of opioids through CME, KOLs. Courts found that the plaintiffs have clearly alleged proximate cause and believe

the tobacco case was not similar to the opioid case, as injuries were directly caused by defendants' injurious conduct. Other elements of the claim are unjust enrichment (reaping billions at the plaintiffs' expenses despite questionable business practices, with the claim of thirteen categories that represented substantial loss); common law fraud (marketing defendants violated duty by "intentionally and unlawfully making knowingly false statements" and intentionally and unlawfully omitting and/or concealing information"); negligence and violating the duty of care (minimizing the risk of addiction through deceptive marketing practices, claiming pseudo-addiction meant people just need more opioids); fraud; and unfair, deceptive trade practices.

Diversion and chargebacks

Diversion involves transferring opioids from a legal to an illicit channel. In most situations, diversion can happen within all channels, including manufacturer to physician office to illicit market or retail pharmacy to illicit market. Chargebacks involve manufacturers providing discounts to distributors for consumer/retailer information, which gives them insight on end-buyers. Plaintiffs claim that the manufacturers should have used this information to evaluate, track and report suspicious orders. Rather, they were using it to create marketing efforts to promote their opioid portfolio.

In the Gryphon testimony, the expert analyst developed a number of metrics to determine any unusual size or frequency to determine diversion. First, volumes were analyzed to determine if scripts were prescribed over a "static threshold," historical purchases were analyzed and scripts were compared with national averages for the same-labeler opioid product. According to the testimony, the defendants did not notify the authorities of irregular patterns. Rather, they used the information to develop better sales strategies. Chargeback data allowed them to understand the buying patterns at the pharmacy level better and to determine whether their buying patterns exceeded regulations. According to the testimony, if the defendants appropriately identified the suspicious activity, the number of opioid prescriptions may have been more than 50% less than the amount actually filled from 1997-2006 and 2008-2017.

Generic promotion

Based on our understanding, many of these marketing efforts did not always involve the promotion of branded products. Rather, these efforts broadly promoted the benefit of opioids (both branded and generics) and opioid therapies to address pain.

In the generic manufacturers' motion for partial summary judgment, the generic manufacturers claimed that they did not promote the safety or efficacy of their generic drugs and that there is no evidence that they delivered any false statements to prescribers of them. Given the Hatch-Waxman amendments require a "duty of sameness" thereby "prohibiting a generic manufacturer from changing the design of a generic medicine, altering its FDA-approved labeling or issuing additional warnings," these manufacturers believe that the failure-to-disclose claims against generic manufacturers are pre-empted.

Based on the ARCOS data, the market share for generic manufacturers exceeds Purdue's by nearly 3x. A number of states have limited opioid prescribing to a 7-day supply, and although the CDC has recommended guidelines to limit prescribing opioids for chronic pain (see its *letter*), but based on their market share, these limits were not self-imposed by the manufacturers. Based on the National Household Survey on drug use and health, 50.5% of non-medical opioid use came from friends or relatives. Based on the various MDL filings, while abuse was found across all opioids, it was most common among those prescribed hydrocodone versus strong drugs such as Oxy. Therefore, those on stronger drugs may not have a reason to try weaker drugs and may have targeted alternative sources for stronger opioids. Ultimately, in our opinion, any 120-day opioid scripts likely heightened opioid abuse.

Oklahoma case

- Purdue first settled the Oklahoma case for $270mn (see *consent*).
- Teva followed Purdue and settled July 2019 (see *consent*).
- The state is targeting J&J two primary drugs, Duragesic (fentanyl) and Nucynta (tapentadol), and Noramco, a subsidiary of J&J that supplied API (active pharmaceutical ingredient) to other opioid manufacturers. J&J's market share of these two drugs was not significant, but Noramco would convert thebaine (supplied by Tasmanian Alkaloids, which was a subsidiary of Noramco) into oxy and hydrocodone and sell this API to other manufacturers such as Purdue Pharma. According to a *J&J presentation*, Noramco had long-term agreements with all seven US generic companies. According to the presentation, J&J's U.S. market share of opioids was: Oxycodone (65% in 2015), Hydrocodone (54%) and Morphine (60%). The plaintiffs claim J&J should be responsible for the $17bn in estimated abatement costs and that the company created a public nuisance that killed over 6,000 Oklahomans by "abandoned all standards of responsible conduct in their blind resolve to make money from their drugs." Based on the allocation analysis, we believe a $5bn settlement implies a roughly $200bn global settlement. Therefore, we believe a final settlement must range from $1bn to $3bn. There is the possibility of contribution risk (allowed only in certain states, including Oklahoma) that arises from public nuisance and is joint and severable. It may take a long time to argue contribution, but it would not surprise us if JNJ targets TEVA and Purdue post a final settlement.

Negotiating Class

With over 5,000 counties and 19,500 "incorporated places" in the US, a nationwide settlement has a number of challenges. Furthermore, the defendants are likely not going to settle unless it involves all parties and not select municipalities (according to Entry 1683 from the MDL 2804 case: "defendants need a comprehensive release from all litigants and potential litigants.") . In preparation for a nationwide settlement, the plaintiffs have proposed creating a *negotiating class* involving a comprehensive group including all cities and counties represented by active litigants in the MDL. According to them, this class will create a "unified body to enter into further negotiations with defendants," to maximize the settlement and fairly allocate the funds. The proposed process and supermajority requirements were taken from the American Law Institute's Principles of the Law of Aggregate Litigation and the 75% voting requirement used in the asbestos bankruptcy. This proposal "is neither aimed at being a vehicle for litigation or settlement." It will not prevent individual cases from cities and counties from settling or moving forward and will not affect existing actions filed by current class members. The states are opposing this class, as it will affect their settlements, which they argue may be larger.

Allocation formula

The allocation involves a three-step formula: 1) volume through morphine milligram equivalent (MME) data; 2) overdose deaths; and 3) opioid use disorder (OUD) cases. Each step is equally weighted when determining the final allocation. 10% of the allocation will be set aside for plaintiff fees and each county and city class will internally allocate the settlement "among themselves."

Opioid Use Disorder (OUD) formula

The OUD is different than the physical opioid dependence. The constant use of opioids leads to physical issues tied to tolerance and withdrawal. Risks of OUD after prescription opioid use are not only dosage and length of use; they are also tied to age, the history of illicit drug use and psychiatric and substance use disorder. OUD involves the inability to adjust to a normalized environment, which may lead to coping strategies that increase

opioid abuse and dependence. Under the Diagnostic and Statistical Manual of mental disorders (DSM) part 5, OUD combines opioid abuse and dependence criteria. The revised criteria exclude legal problems but include cravings, which was included in DSM-IV. Diagnoses were made on three levels: mild (2-3 symptoms), moderate (4-5 symptoms) and severe (6 or more symptoms). The symptoms include failure to meet or adhere to obligations, recurrent physical situations, continued use despite the social risks of their use, legal problems that may arise from continued use, tolerance, withdrawal, overuse, attempting to control use, physical or emotional problems, giving up a normal daily life to continue to use and spending time to acquire and use opioids. Unlike opioid misuse, which accounts for nearly 5% of the US population, OUD captures 0.8% of the US population. Each state is assigned an OUD allocation percentage by taking the state OUD to the nationwide OUD (2,111,800 persons).

Overdose Deaths

As reported by the National Center for Health Statistics, CDC and DHHS, the data include death count caused by opioid abuse. The rate is adjusted to account for under-reporting (Ruhm Adjustment) and then divided by the national figure to allocate a factor by state.

MME adjusted volume

Pill count is not relevant when comparing the culpability of the various opioid manufacturers or market share by state. Therefore, to compare the effect of the various opioids, we adjusted the strengths of each based on its MME. For example, fentanyl is nearly 100x more potent than morphine and 50x more potent than heroin. Morphine is more hydrophilic, meaning it has poor lipid solubility and roughly 40-50% of the dose reaches the central nervous system. On the other hand, fentanyl is lipophilic, which is why its CNS penetrability is 133x that of morphine. Oxycodone is 1.5x stronger than morphine, while tramadol is 0.1x as potent as morphine. Therefore, to calculate the daily MME, we multiply the number of units/days' supply by the strength per unit and by the MME conversion factor.

To stress the importance of MME, we use the CDC's overdose guidelines, which state that doses above 50 MME/day double the risk of overdose. For further context, most that have overdosed were prescribed 98 MME/day, and 33mg of oxycodone is equivalent to 50 MME (implying the 50 MME/day threshold can be reached by taking 15 mg of Oxy 2x per day). Purdue's OxyContin was launched in 1996 in various strengths. Per the documents, the weakest Oxy was stronger than Percocet, and other Oxy strengths were up to 16x stronger.

Long-acting opioids (OxyContin, Nucynta ER, Opana ER) provide therapy of up to nearly 12 hours. Short-acting opioids (Actiq and Fentora) are used with long-acting ones, and therapy lasts for nearly six hours. According to the prescribing guidelines for Actiq (fentanyl), the drug is indicated to manage breakthrough pain and patients must "remain on around-the-clock opioids" while using it.

Once the MME is calculated, it is adjusted (by each county) to account for MMEs that produced a negative outcome, which accounts for the oversupply of opioids in the various counties and the degree of harm caused by the MMEs. The adjustment involves multiplying the MMEs by the higher of the OUD ratio (1+OUD ratio) and opioid overdose ratio (1+OOD ratio).

FIGURE 24
Morphine adjustment table

Drug Name	Measure	MME Conversion Factor
CODEINE	CAP	0.15
	TAB	0.15
DIHYDROCODEINE	CAP	0.25
	TAB	0.25
FENTANYL	AMP	100.00
	LLPOP	130.00
	LOZ	130.00
	PO/PA	100.00
	TAB	130.00
	VL	100.00
HYDROCODONE	CAP	1.00
	TAB	1.00
	VL	1.00
HYDROMORPHONE	AMP	4.00
	CAP	4.00
	TAB	4.00
	VL	4.00
LEVORPHANOL	TAB	11.00
MEPERIDINE	AMP	0.10
	CAP	0.10
	TAB	0.10
	VL	0.10
MORPHINE	AMP	1.00
	CAP	1.00
	TAB	1.00
	VL	1.00
OXYCODONE	AMP	1.50
	CAP	1.50
	TAB	1.50
OXYMORPHONE	AMP	3.00
	TAB	3.00
	VL	3.00
TAPENTADOL	TAB	0.40

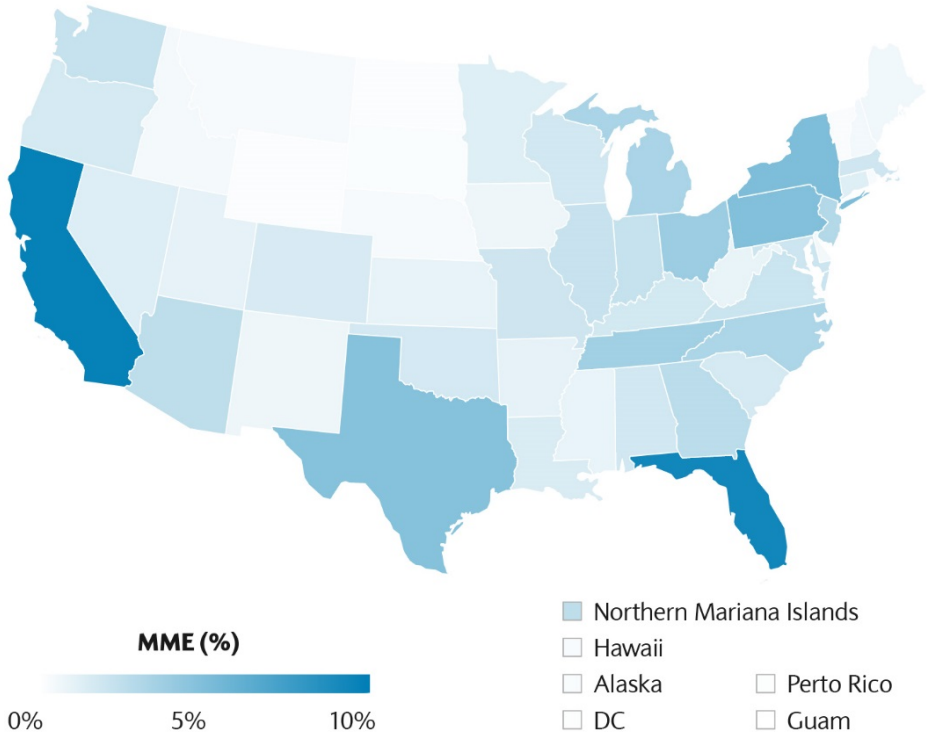
Source: ARCOS, Washington Post, Barclays Research

Opioid background

Of the 24 opium alkaloids, morphine (10% of the opium extract), codeine and thebaine are used in the industry today; they share a number of similar qualities with opium and heroin. Both are synthesized from the same plant; have similar molecular structures; and affect humans with a sense of euphoria, analgesia and depression.

Opioids are prescribed to relax muscles and relieve pain. According to *Cleveland Clinic*, lower back pain is one of the most common pains. As reported by StatNews, according to a paper published by the *Lancet*, "routine use of opioids is not recommended" and the data on the effect of opioids on acute low back pain are "sparse." Despite this, opioids were prescribed for 60% of ED visits for low back pain (1997-2009).

FIGURE 25
ARCOS data, mme percentage by state



Source: ARCOS, Washington Post, Barclays Research

Regulation

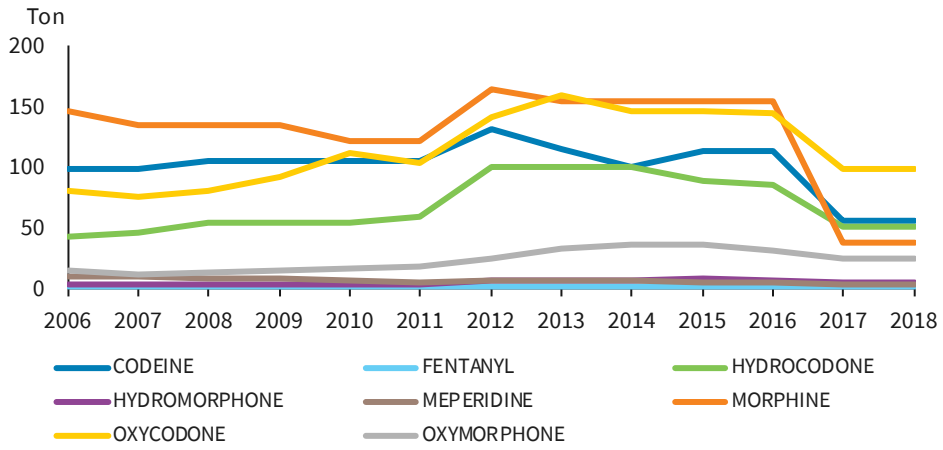
Opioids have been regulated as Schedule II controlled substances by the DEA since 1970. The FDA approves new drugs and reformulations and monitors, with the DEA, the use of opioids. The FDA approved short-acting combinations of Percocet in the 1970s and long-acting formulations (such as MS Contin and OxyContin) in the 1980s and 1990s. At the time a drug has been approved, the FDA can impose "post-market requirements" to assess risk through clinical trials and other types of studies to adjust labels and safety warnings. The Federal Food, Drug, and Cosmetic Act (FDCA) prohibits false drug label and advertising, while the FDA is supposed to regulate the marketing of opioids by requiring companies to offer accurate information. The FDA can remove marketing material if it feels the information violates the law.

Under the Controlled Substances Act, the US attorney general delegates the establishment of production quotas for Schedule I and II controlled substances to the DEA, whose responsibility is to "prevent diversion and abuse of these drugs while ensuring an adequate and uninterrupted supply." Each company within the opioid supply chain must register with the DEA, and each transaction is accounted for by the DEA. The manufacturing quota (MQ) is the maximum amount that can be manufactured each year and is specific to each DEA-registered manufacturer. The DEA has open authority to adjust allotment levels for

registrants. In certain situations, it has taken action against manufacturers for failing to track and report suspicious activity, as it did with MNK in 2017. Even with the accusation that MNK was paying chargebacks, it seemed as if the government could not tie it to various diversion activities. In 2015, MNK received roughly 25% of the US Drug Enforcement Administration's entire annual quota for controlled substances and estimated that its market share of DEA schedule II and III opioid and oral dolid dose medications was also nearly 25%.

Since 2016, production quotas for most schedule II opioids (such as oxycodone, hydrocodone, oxymorphone and fentanyl) have declined nearly 45%. For 2019, the quotas were lower for codeine, hydrocodone, morphine, oxycodone (Figure 29).

FIGURE 26
DEA quotas



Source: DEA, Barclays Research

Other highlights

- According to ARCOS, prescription opioids increased to 700mg per person in 2007 from 96mg per person in 1997. Oxycontin entered the market in 1995, and in 2010 prescriptions filled peaked at 62mn. During this time, Oxy use for non-cancer pain increased to 6.2mn scripts in 2007 from nearly 700,000 in 1997. The increase was attributed to a number of reasons, such as direct marketing to physicians and downplaying risks.
- 59,400 pharmacies represented 92% of retail prescriptions dispensed by the US. While the average rate of opioid prescription per person per year decreased from the peak of 6.9% in 2010 to 3.8% in 2015, according to the Iqvia Xponent database, in 2017, there were over 191mn prescriptions dispensed in the US, as time duration per prescription in certain counties also increased.

FIGURE 27
Opioid Drugs

Drug (Branded)	Description	Illicit Uses	Control Status
Fentany (Actiq, Fentora, Duragesic]	Fentanyl is a potent synthetic opioid. It was introduced into medical practice as an intravenous anesthetic under the trade name of Sublimaze in the 1960s. Licit fentanyl pharmaceutical products are diverted via theft; fraudulent prescriptions; and illicit distribution by patients, physicians, and pharmacists. Fentanyl is about 100 to nearly 140 times more potent than morphine as an analgesic. It is a μ-opioid receptor agonist, with high lipid solubility and a rapid onset and short duration of effects. Fentanyl rapidly crosses the blood-brain barrier. It is similar to morphine or oxycodone in its effects.	Fentanyl is abused for its intense euphoric effects. It can serve as a direct substitute for heroin in opioid-dependent individuals. However, it is a very dangerous substitute for heroin because it is much more potent and results in frequent overdoses that can lead to respiratory depression and death.	Schedule II
Hydromorphone (Dilaudid]	Hydromorphone, also known as dihydromorphinone, is an opioid used to treat moderate to severe pain. Long-term use is recommended for pain due to cancer. It may be used by mouth or by injection into a vein, muscle, or under the skin. Hydromorphone is derived from morphine. Pharmacological and toxic effects, clinical indications and contraindications, abuse and dependence liabilities of hydromorphone are similar to other schedule II opioid analgesics such as morphine and oxycodone. It has an analgesic potency of two to eight times greater than that of morphine and a rapid onset of action. The analgesic effect is felt within 15 and 30 minutes following its administration through injection and oral routes, respectively. The analgesic action usually lasts for more than five hours.	Hydromorphone, similar to other schedule II opioids, has a high abuse and dependence potential and produces tolerance. Acute overdose of hydromorphone can produce severe respiratory depression, drowsiness progressing to stupor or coma, lack of skeletal muscle tone, cold and clammy skin, constricted pupils, and a reduction in blood pressure and heart rate	Schedule II
Oxycodone (Tylox, Percodan, OxyContin]	Oxycodone is widely used in clinical medicine. It is marketed either alone as controlled release (OxyContin) and immediate release formulations (OxyIR, OxyFast), or in combination with other nonnarcotic analgesics such as aspirin (Percodan) or acetaminophen (Percocet). In 2004, the Food and Drug Administration (FDA) approved generic forms of controlled release oxycodone. The pharmacology of oxycodone is essentially similar to that of morphine. Effects include analgesia, sedation, euphoria, feelings of relaxation, respiratory depression, constipation, papillary constriction, and cough suppression. A 10 mg dose of orally administered oxycodone is equivalent to a 10 mg dose of morphine. Behavioral effects of oxycodone can last up to five hours. The drug is most often administered orally.	Oxy was introduced in 1996. Oxycodone is abused for its euphoric effects. It is similar to morphine in addressing a number of symptoms. Oxycodone is abused orally or intravenously. The tablets are crushed and sniffed, dissolved in water and injected, or the vapors inhaled.	Schedule II
Buprenorphine (Buprenex, Suboxone, Subutex)	Buprenorphine was first marketed 1985 as a schedule V narcotic analgesic. The drug produces the effects typical of both pure mu agonists (eg, morphine) and partial agonists (eg, pentazocine), depending on dose, pattern of use and population taking the drug. Buprenorphine is 20-30 times more potent than morphine. However, acute, high doses have been shown to have a blunting effect on physiological and psychological effects, due to its partial opioid activity.	Buprenorphine has been abused through various routes of administration, including intravenous, and pills.	Schedule III

Drug (Branded)	Description	Illicit Uses	Control Status
Hydrocodone (Vicodin, Lortab, Lorcet-HD, Hycodan, Vicoprofen)	Hydrocodone is used to treat severe pain for prolonged duration. It used as cough suppressant in adults. It is sold as the combination acetaminophen/hydrocodone or ibuprofen/hydrocodone. Since 2009, hydrocodone has been the second most frequently prescribed opioid. Hydrocodone is a semi-synthetic opioid closely related to codeine. Hydrocodone binds and activates the mu-opioid receptor in the CNS. Hydrocodone use leads to analgesia, euphoria, respiratory depression, decreased gastrointestinal motility and physical dependence.	Diversion occurs through questionable prescriptions, theft, and illicit purchases. Of the various opioids, hydrocodone is the highest number of pills found in illicit traffic. . The 2016 Monitoring the Future Survey reported that 0.8%, 1.7% and 2.9% of 8th, 10th, and 12th graders, respectively, used Vicodin for nonmedical purposes.	Schedule II
Methadone (Methadose, Dolophine]	Methadone is a synthetic narcotic that was created to address a morphine shortage. Pharmacological and toxic effects, abuse and dependence liabilities are similar to other Schedule II opioids such as morphine and oxycodone. 8-10 mg of methadone is equivalent to 10 mg of morphine. Methadone given orally is one-half as effective as its intramuscular administration. Pain relief from a dose of methadone lasts 4-8 hours, but the drug may stay in the body for up to 59 hours.	Methadone has abuse potential. According to the National Survey on Drug Use and Health, 2.5 million persons age 12 and older in 2012 reported using methadone for non-medical purposes, an increase from 2.10 million in 2011. The American Association for Poison Control Centers reported 4,693 cases and 51 deaths due to methadone in 2012. The Drug Abuse Warning Network estimated emergency department visits due to methadone at 66,870 in 2011.	Schedule II
Morphine (MS-Contin, Oramorph SR, MSIR, Roxanol, Kadian, and RMS]	Morphine is a non-synthetic narcotic and is used for the treatment of pain. A small percentage of the morphine obtained from opium is used directly for pharmaceutical products. The remaining morphine is processed into codeine and other derivatives. Morphine acts directly on the central nervous system and is used to address pain associated with myocardial infarction and labor. The effect of morphine is felt after 20 minutes when given intravenously and after 60 minutes when given by mouth and can last 3–7 hours.	Withdrawal symptoms may occur. Side effects include drowsiness, vomiting, and constipation. A large overdose can cause asphyxia and death by respiratory depression. Overdose treatment includes the administration of naloxone. The latter reverses the effect but may lead to withdrawal in opiate-addicted subjects. The minimum lethal dose of morphine sulfate is 120 mg, but 60 mg can bring sudden death. In serious drug dependency (high tolerance), 2000–3000 mg per day can be tolerated.	Schedule II
Oxymorphone (Opana, Opana ER)	Oxymorphone is a schedule II opioid. The FDA approved it for immediate-release (IR) and extended-release (ER) oxymorphone oral tablets under the brand names Opana and Opana ER. At high doses, oxymorphone can interact with other opioid receptors. Other pharmacological effects of opioid agonists include anxiolysis, euphoria, feelings of relaxation, respiratory depression, constipation, miosis, and cough suppression.	Oxymorphone has high abuse and dependence potential. Snorting, oral ingestion, and injection are routes of administration. The Drug Abuse Warning Network estimates that emergency department visits associated with oxymorphone increased from 4,599 in 2010 to 12,122 in 2011.	Schedule II
Remifentanil (Ultiva]	Remifentanil is a short-acting synthetic opioid. It is given to patients during surgery to relieve pain.	Remifentanil can cause euphoria and has the potential for abuse. However, due to its rapid metabolism and short-acting half-life, the likelihood of becoming abused is quite low.	Schedule II
Codeine (Aspalgin, Codral, Nurofen Plus, Panadeine Forte, Panamax Co, Mersyndol, Panalgesic)	Codeine is used mostly to treat mild to moderate degrees of pain. It can be combined with paracetamol (acetaminophen) or a nonsteroidal anti-inflammatory drug (NSAID) such as aspirin or ibuprofen. It is usually taken by mouth and works after half an hour, with maximum effect at two hours. Its effects last for four to six hours. The drug is the most commonly used opiate. It is on the World Health Organization's List of Essential Medicines, the most effective and safe medicines needed in a health system. The wholesale cost in the developing world was US$0.04-0.29 per dose as of 2014. In the United States, it costs about one dollar per dose. Codeine makes up about 2% of opium.	Heroin or other opiate addicts may use codeine to ward off the effects of withdrawal. It is also used with the anti-nausea medication promethazine. In the 1990s, it started to be mixed with soft drinks to be used as a recreational drug.	Schedule II

Drug (Branded)	Description	Illicit Uses	Control Status
Dihydrocodeine (Trezix, Dvorah, Panlor DC, Panlor SS, Synalgos DC)	Dihydrocodeine is a semi-synthetic opioid analgesic prescribed for pain and can be compounded with paracetamol (acetaminophen, as in co-dydramol) or aspirin. The drug can be used for the management of moderate to severe pain, as well as shortness of breath. It is also a powerful cough suppressant like all other members of the immediate codeine family. It is twice as strong as codeine.	Dihydrocodeine can lead to a euphoric high when taken in higher-than-therapeutic doses. The typical recreational dose can be from 70 mg to 500 mg.	Schedule II
Meperidine (Demerol, Meperitab, Mepergan, Meprozine, Mepergan Fortis)	Meperidine, also known as pethidine and sold under the brand name Demerol, is a synthetic opioid pain medication. It is delivered as a hydrochloride salt in tablets; as a syrup; or by intramuscular, subcutaneous, or intravenous injection. Compared with morphine, meperidine was thought to be safer, but this was shown to be untrue. The drug leads to addiction and, due to its toxic metabolite norpethidine, is more toxic than other opioids.	Use of meperidine declined between 1997 and 2002, versus increases for fentanyl, hydromorphone, morphine, and oxycodone. The number of dosage units of meperidine reported lost or stolen in the US increased 16.2% between 2000 and 2003.	Schedule II
Opium (Paregoric, Opium Tincture, Deodorized)	Opium is obtained from the opium poppy. Approximately 12 percent of the opium latex is made up of the analgesic alkaloid morphine, which is processed chemically to produce heroin and other synthetic opioids. The latex also contains codeine and thebaine. Opium inhibits muscle movement in the bowels, leading to constipation. It also can dry out the mouth.	Opium can be smoked, intravenously injected, or taken in pill form. It can also be used with other drugs, for example marijuana and methamphetamines.	Schedule II
Tapentadol (Nucynta, Nucynta ER]	Tapentadol is an opioid analgesic associated with the benzenoid class. Analgesia occurs within 32 minutes of oral administration and lasts for 4–6 hours. Tapentadol is used for the treatment of moderate to severe pain tied to injury and surgery and for chronic musculoskeletal pain. It is also indicated for controlling the pain of diabetic neuropathy when around-the-clock opioid medication is required. Its general potency is between tramadol and morphine.	Tapentadol may have lower levels of abuse than other opioids.	Schedule II
Levorphanol (Levo Dromoran)	Levorphanol is used to treat moderate to severe pain. It is one of four enantiomers of the compound racemorphan. Levorphanol is 6-8 times as potent as morphine.		Schedule II
Tramadol (Ultram, Ultracet)	Due to diversion, the label was changed to address its addition and abuse. The drug is an opioid analgesic, and abuse and adverse events of tramadol are similar to those of other opioid analgesics. Tramadol also acts on the monoamine re-uptake systems by inhibiting the re-uptake into nerve terminals of norepinephrine and serotonin.	Tramadol is most commonly abused by narcotic addicts, chronic pain patients, and health professionals.	Schedule IV
Amphetamines (Adderall [amphetamine and dextroamphetamine], Dexedrine [dextroamphetamine)]	Amphetamines are stimulants that speed up the body's system. Most of the drugs are used for attention-deficit hyperactivity disorder (ADHD). The effects of amphetamines and methamphetamine are similar to cocaine, but the combination is slower and their duration longer. In contrast to cocaine, which is completely metabolized, methamphetamine remains in the central nervous system longer. Physical effects of amphetamine use include increased blood pressure and pulse rates, insomnia, loss of appetite, and physical exhaustion.	Amphetamines are generally taken orally or injected, sometimes in the crystallized form of methamphetamine hydrochloride. Overdose effects include agitation, increased body temperature, hallucinations, convulsions, and possibly death.	Schedule II
Methylphenidate (Ritalin [IR, LA, and SR], Concerta, Metadate-[CD and ER], Methylin-[IR and ER] and Focalin-[IR and ER]]	Methylphenidate is a central nervous system (CNS) stimulant. These products are mostly prescribed to children for the treatment of attention deficit hyperactivity disorder (ADHD). Methylphenidate is a CNS stimulant and produces a number of effects, including appetite suppression and increased alertness. It is extensively metabolized and about 80% is excreted in the urine. Only 20% of the administered oral dose is bioavailable due to extensive first-pass metabolism.	Abusers use methylphenidate to increase attention and stay awake. The drug can be combined with alcohol or some other depressant to feel more alert or less drunk. The drug can be snorted or injected.	Schedule II

Source: DEA, Wikipedia.org, Drugs.com, Barclays Research

FIGURE 28

Total Shipment in MME - By Drug

Drug Name	Drug Code	2006	2007	2008	2009	2010	2011
BUPRENORPHINE	9064	8,680,620,000	15,249,474,600	26,556,348,600	36,779,960,100	44,773,717,200	51,260,476,500
CODEINE	9050	2,814,436,884	2,826,049,304	2,715,276,960	2,551,860,584	2,421,266,423	2,522,349,569
DIHYDROCODEINE	9120	41,244,875	35,547,605	28,831,423	21,716,270	18,907,723	19,256,255
FENTANYL BASE	9801	55,726,886,800	60,234,262,400	62,473,633,300	61,500,039,900	68,770,455,000	65,238,313,400
HYDROCODONE	9193	29,856,316,980	35,867,501,620	35,532,223,490	37,754,135,230	39,096,895,200	42,395,541,700
HYDROMORPHONE	9150	3,606,651,200	4,126,067,840	4,702,405,280	5,358,469,920	5,631,708,240	6,322,615,800
LEVORPHANOL	9220L	29,545,560	33,042,570	28,795,030	28,770,280	4,853,970	6,042,520
MEPERIDINE (PETHIDINE)	9230	416,003,490	393,617,912	345,769,717	270,177,229	233,316,747	207,446,959
METHADONE	9250B	111,738,482,480	118,933,389,120	118,502,876,000	121,551,738,320	123,728,316,720	122,480,800,800
MORPHINE	9300	17,507,154,470	19,051,425,890	20,609,711,370	22,271,482,450	22,915,640,730	23,645,912,640
OPIUM POWDERED	9639	46,416,480	5,266,914,290	32,202,680	35,017,330	34,446,880	36,001,140
OXYCODONE	9143	55,551,334,320	68,201,490,660	73,459,618,950	83,638,586,070	95,537,980,590	95,348,202,120
OXYMORPHONE	9652	174,525,870	1,171,521,360	2,136,846,900	3,044,133,930	4,066,307,400	6,521,238,300
REMIFENTANIL	9739	103,136,400	119,471,400	159,393,600	163,287,000	164,053,800	206,771,400
TAPENTADOL	9780				394,318,916	1,197,962,500	2,062,134,560
Grand Total		**286,292,755,809**	**331,509,776,571**	**347,283,933,300**	**375,363,693,529**	**408,595,829,122**	**418,273,103,663**

Drug Name	Drug Code	2012	2013	2014	2015	2016	2017
BUPRENORPHINE	9064	60,306,268,500	68,796,721,200	76,113,799,500	83,229,772,800	89,823,225,600	100,535,552,100
CODEINE	9050	2,313,578,168	2,098,642,367	2,169,862,925	2,796,272,166	2,614,275,158	2,422,681,920
DIHYDROCODEINE	9120	13,498,775	6,848,830	715,713	5,192,300	8,257,695	7,584,995
FENTANYL BASE	9801	62,236,010,200	59,217,042,300	58,774,846,000	56,324,321,300	51,283,428,300	42,190,669,300
HYDROCODONE	9193	41,897,556,100	40,466,688,410	37,868,220,590	32,872,244,690	30,368,584,790	27,129,590,360
HYDROMORPHONE	9150	7,276,990,560	7,357,803,800	7,220,073,120	6,884,778,880	6,365,246,720	5,616,364,280
LEVORPHANOL	9220L	13,787,840	17,902,060	19,587,040	18,753,240	22,900,240	42,030,230
MEPERIDINE (PETHIDINE)	9230	175,643,975	147,919,719	121,175,914	104,644,770	87,063,716	69,864,129
METHADONE	9250B	121,351,446,960	119,016,770,800	120,310,068,240	122,103,119,280	116,208,177,920	117,531,700,720
MORPHINE	9300	24,242,359,010	23,040,728,730	22,150,789,810	21,100,551,060	19,184,739,230	16,604,588,250
OPIUM POWDERED	9639	33,204,360	32,213,880	32,709,600	33,666,480	33,233,040	32,438,160
OXYCODONE	9143	91,943,526,705	86,066,458,410	85,923,670,485	86,355,579,180	82,166,837,565	73,284,520,260
OXYMORPHONE	9652	4,806,775,590	4,868,137,440	5,075,134,560	5,091,530,550	4,692,865,650	3,330,807,960
REMIFENTANIL	9739	210,375,000	222,588,000	235,013,400	260,026,200	284,990,400	298,661,400
TAPENTADOL	9780	2,619,610,812	2,504,010,248	2,356,468,524	2,378,152,628	2,490,674,628	2,235,881,944
Grand Total		**419,440,632,555**	**413,860,476,194**	**418,372,135,420**	**419,558,605,524**	**405,634,500,652**	**391,332,936,008**

Source: ARCOS, Barclays Research

FIGURE 29

Total Shipment in MME Per 100k Population – By State

State	2006	2007	2008	2009	2010	2011
ALABAMA	126,425,188	157,756,366	154,743,654	163,490,821	163,816,079	177,372,002
ALASKA	114,737,869	121,117,952	127,199,699	131,789,140	125,777,429	128,923,853
AMERICAN SAMOA	2,690,615	1,641,763	1,517,842	1,705,829	1,594,591	1,573,485
ARIZONA	139,560,329	173,246,006	160,414,738	169,343,437	144,863,374	150,911,993
ARKANSAS	88,582,449	98,945,960	108,376,850	114,685,659	116,301,252	119,252,408
CALIFORNIA	82,143,473	91,675,104	99,292,101	104,790,306	99,611,359	103,002,279
COLORADO	83,168,606	94,367,434	103,381,494	110,598,552	101,914,059	109,452,480
CONNECTICUT	153,035,916	165,896,244	179,086,730	184,113,347	190,754,210	190,107,917
DELAWARE	144,231,076	164,451,688	190,114,427	212,466,865	211,188,231	230,271,999
DISTRICT OF COLUMBIA	106,827,271	115,578,517	117,958,661	120,234,256	123,781,730	116,050,108
FLORIDA	154,065,076	194,145,855	198,042,418	223,089,011	219,032,716	195,231,430
GEORGIA	87,762,276	100,454,189	104,907,456	113,733,514	112,858,143	117,710,465
GUAM	12,116,874	13,554,186	12,854,165	13,812,584	12,572,600	13,867,832
HAWAII	83,530,941	87,745,894	94,160,935	99,824,505	92,992,758	96,273,322
IDAHO	81,287,365	91,604,551	102,979,596	114,485,975	107,447,357	114,527,593
ILLINOIS	64,774,469	67,920,655	72,507,629	74,797,042	78,508,458	80,087,138
INDIANA	109,243,766	124,105,646	134,929,270	146,445,089	149,606,676	156,803,204
IOWA	51,827,031	59,478,675	63,211,841	66,020,067	70,212,505	73,848,119
KANSAS	83,968,759	96,263,160	102,641,415	103,931,535	107,716,906	112,760,204
KENTUCKY	104,463,903	117,366,438	133,638,348	151,869,974	163,389,001	174,864,184
LOUISIANA	124,226,006	146,170,174	126,584,830	128,880,997	130,865,527	136,623,379
MAINE	181,499,198	208,275,790	240,778,301	261,349,683	262,042,585	250,827,300
MARYLAND	136,345,904	149,362,466	162,785,331	182,786,206	191,376,003	197,476,651
MASSACHUSETTS	123,274,711	138,784,337	150,028,083	162,719,040	169,412,055	174,217,959
MICHIGAN	92,790,251	102,691,392	114,337,200	124,743,122	137,967,611	142,741,493
MINNESOTA	55,591,061	61,120,933	71,836,612	73,743,103	76,042,337	77,668,938
MISSISSIPPI	68,257,392	91,635,808	88,610,432	98,368,562	106,241,758	110,808,194
MISSOURI	90,936,444	93,664,438	101,624,507	107,474,041	114,373,337	123,893,082

Source: ARCOS, Barclays Research

FIGURE 29

Total Shipment in MME Per 100k Population – By State (continued)

State	2006	2007	2008	2009	2010	2011
MONTANA	101,888,276	112,727,685	122,769,923	126,923,839	125,959,524	123,294,584
NEBRASKA	52,884,888	57,669,606	62,346,752	66,164,516	67,007,170	69,211,884
NEVADA	182,847,108	206,372,181	215,513,000	223,462,978	174,852,827	181,538,189
NEW HAMPSHIRE	114,080,807	135,223,924	140,617,977	159,725,852	165,780,161	167,578,326
NEW JERSEY	104,158,956	114,663,608	122,999,628	135,130,817	139,589,802	145,010,919
NEW MEXICO	93,253,419	104,054,382	116,972,674	129,340,814	124,701,961	133,093,344
NEW YORK	100,651,890	110,807,980	118,680,639	129,463,257	135,460,109	137,776,172
NORTH CAROLINA	109,708,248	123,981,710	125,735,823	141,000,137	128,643,496	137,252,574
NORTH DAKOTA	53,972,977	64,365,779	76,066,499	73,063,047	72,711,853	76,239,607
OHIO	97,586,004	108,402,431	120,300,600	129,419,908	136,888,149	141,140,164
OKLAHOMA	110,585,972	127,429,618	141,590,201	149,901,641	150,950,203	159,457,663
OREGON	157,574,159	178,734,294	189,633,452	197,924,827	185,249,698	187,562,410
PENNSYLVANIA	115,487,273	130,384,404	147,915,603	163,511,265	172,478,982	174,638,373
PUERTO RICO	34,767,440	35,010,969	36,748,110	36,560,066	35,146,308	32,526,232
RHODE ISLAND	153,367,854	168,334,418	186,429,139	197,595,825	216,976,492	218,852,402
SOUTH CAROLINA	88,971,167	107,850,529	108,690,164	125,843,445	122,113,609	129,877,563
SOUTH DAKOTA	56,361,995	63,356,139	71,696,044	75,614,262	80,316,956	302,776,117
TENNESSEE	147,552,596	180,267,721	189,471,217	213,693,105	209,995,551	213,494,328
TEXAS	62,697,084	72,130,750	75,333,593	79,403,816	70,497,403	73,667,945
UTAH	126,297,651	141,613,742	154,066,554	160,275,474	137,043,161	142,272,077
VERMONT	124,770,129	148,756,009	173,828,807	192,753,610	197,724,960	191,635,722
VIRGIN ISLANDS	11,871,879	16,488,513	14,673,063	13,941,246	14,733,644	18,390,028
VIRGINIA	76,526,644	86,699,449	91,690,894	102,079,311	98,964,714	103,803,061
WASHINGTON	138,559,584	152,011,234	166,322,328	172,070,172	153,849,212	152,569,840
WEST VIRGINIA	162,363,318	173,167,062	187,994,733	207,425,027	214,878,326	223,819,189
WISCONSIN	86,346,482	194,733,283	108,177,686	116,734,122	118,215,035	120,702,354
WYOMING	72,735,579	79,489,044	89,714,953	95,032,390	88,500,654	90,075,919
Grand Total	**5,485,233,586**	**6,323,748,074**	**6,674,524,610**	**7,175,347,021**	**7,121,490,592**	**7,525,405,996**

Source: ARCOS, Barclays Research

FIGURE 29

Total Shipment in MME Per 100k Population – By State (continued)

State	2012	2013	2014	2015	2016	2017
ALABAMA	198,778,194	207,762,771	208,961,804	211,672,044	204,009,489	192,022,852
ALASKA	132,116,144	133,501,325	137,199,538	143,375,027	139,257,695	139,184,993
AMERICAN SAMOA	1,132,395	1,277,553	952,688	865,032	1,202,454	689,478
ARIZONA	154,314,296	147,954,223	152,468,809	150,134,034	147,463,028	134,927,977
ARKANSAS	126,234,604	123,129,005	129,483,940	132,715,504	127,958,309	119,591,837
CALIFORNIA	103,573,975	100,263,147	98,859,027	96,737,122	89,441,370	83,702,618
COLORADO	115,431,503	109,829,400	109,238,800	109,912,172	105,337,946	100,269,934
CONNECTICUT	200,275,175	200,980,578	208,165,239	212,581,002	204,442,839	209,141,536
DELAWARE	227,227,454	221,453,485	225,314,098	230,586,826	225,992,197	232,835,334
DISTRICT OF COLUMBIA	117,297,235	116,727,865	122,669,043	123,628,436	123,702,273	128,659,418
FLORIDA	157,637,282	137,019,886	137,219,408	140,090,219	140,271,070	135,053,317
GEORGIA	120,560,940	120,366,659	120,727,708	123,886,897	121,811,240	118,977,803
GUAM	13,380,752	14,802,081	13,733,906	13,623,891	10,904,745	10,022,873
HAWAII	95,985,015	92,865,892	87,983,178	85,861,809	81,202,990	76,450,948
IDAHO	123,764,314	124,613,669	127,853,324	128,348,770	124,443,510	119,426,121
ILLINOIS	79,281,029	79,280,679	81,480,938	82,324,343	80,487,221	79,042,880
INDIANA	166,509,570	164,334,480	156,634,440	150,150,438	141,464,783	136,813,966
IOWA	75,396,597	69,970,788	70,381,032	69,228,935	65,912,350	60,786,288
KANSAS	118,848,984	118,027,003	121,087,943	119,635,207	111,905,825	104,241,196
KENTUCKY	182,518,599	182,626,478	200,261,928	204,448,538	199,836,033	201,457,681
LOUISIANA	142,578,042	140,803,437	142,699,477	140,511,098	140,308,858	138,090,446
MAINE	248,520,533	238,087,558	238,235,163	239,661,969	226,826,802	213,176,589
MARYLAND	199,457,013	202,555,438	207,260,375	215,935,700	215,112,910	218,592,653
MASSACHUSETTS	179,374,633	184,102,217	185,617,267	188,373,852	184,000,991	188,117,614
MICHIGAN	145,509,454	145,298,203	148,810,531	150,111,145	144,461,550	140,052,423
MINNESOTA	85,411,011	88,955,484	92,360,784	92,253,765	88,861,121	84,191,213
MISSISSIPPI	116,711,836	116,565,301	120,052,694	122,396,521	121,486,287	116,847,718
MISSOURI	128,364,048	125,478,159	126,709,431	123,642,338	119,249,168	113,019,941

Source: ARCOS, Barclays Research

FIGURE 29

Total Shipment in MME Per 100k Population – By State (continued)

State	2012	2013	2014	2015	2016	2017
MONTANA	132,095,015	132,336,744	131,047,722	126,024,522	119,890,524	114,834,200
NEBRASKA	70,600,325	69,323,090	70,116,087	71,340,960	70,867,350	66,376,396
NEVADA	180,075,926	161,848,792	156,615,793	154,493,040	149,525,866	136,860,048
NEW HAMPSHIRE	183,452,711	189,217,013	203,153,993	210,176,409	202,504,542	203,032,215
NEW JERSEY	143,611,825	144,811,322	147,381,121	147,314,064	142,569,554	135,032,073
NEW MEXICO	137,525,843	135,122,468	150,640,929	160,819,113	160,640,098	163,066,382
NEW YORK	135,919,423	133,159,592	133,939,976	136,304,366	131,913,425	128,624,571
NORTH CAROLINA	149,163,772	155,467,530	157,819,725	164,076,697	160,704,677	155,496,634
NORTH DAKOTA	80,865,061	82,038,422	85,183,118	83,646,268	74,720,351	70,463,959
OHIO	136,674,368	132,591,532	133,357,204	133,809,035	130,377,846	125,799,425
OKLAHOMA	167,210,052	169,091,285	174,865,871	172,682,863	168,236,371	162,738,516
OREGON	185,602,285	179,880,537	177,426,831	170,395,550	155,084,170	145,963,695
PENNSYLVANIA	184,218,500	182,969,374	188,115,062	190,621,894	187,369,848	183,544,242
PUERTO RICO	29,791,759	30,316,190	29,593,154	31,892,039	30,809,386	30,734,035
RHODE ISLAND	227,249,688	236,266,818	237,348,365	253,558,061	259,871,124	263,613,604
SOUTH CAROLINA	142,846,935	145,754,471	146,151,398	143,817,697	140,760,988	135,467,988
SOUTH DAKOTA	76,904,333	78,467,185	85,839,022	83,477,473	72,141,772	62,021,126
TENNESSEE	228,259,128	223,537,980	224,569,906	206,199,944	191,997,708	182,727,991
TEXAS	75,426,791	77,485,830	76,167,919	74,962,528	72,923,817	69,295,268
UTAH	150,326,081	153,458,166	155,310,967	156,828,920	153,003,903	144,853,722
VERMONT	197,567,460	210,079,000	230,863,163	249,661,900	251,510,612	266,748,571
VIRGIN ISLANDS	15,884,356	15,617,210	14,501,339	14,923,761	12,801,703	11,812,988
VIRGINIA	110,148,336	112,668,455	115,271,634	116,791,140	115,057,658	109,046,512
WASHINGTON	147,819,925	144,610,141	145,122,842	148,547,886	141,476,838	136,882,245
WEST VIRGINIA	237,993,726	235,111,726	242,623,311	237,184,578	218,483,156	204,927,829
WISCONSIN	125,312,298	125,010,944	126,607,561	127,207,165	117,574,034	108,095,283
WYOMING	99,473,296	101,240,272	103,661,072	104,606,840	98,473,100	93,003,431
Grand Total	**7,508,209,829**	**7,466,114,841**	**7,615,717,582**	**7,674,057,332**	**7,418,645,465**	**7,206,450,582**

Source: ARCOS, Barclays Research

FIGURE 30

Total Shipment in MME – By State

State	2006	2007	2008	2009	2010	2011
ALABAMA	5,622,281,972	7,015,573,687	6,881,596,114	7,270,585,297	7,829,939,379	8,477,915,187
ALASKA	719,328,140	759,332,307	797,450,808	826,229,405	893,306,727	915,657,574
AMERICAN SAMOA	1,541,208	940,539	873,100	979,162	1,048,541	1,033,309
ARIZONA	7,160,294,931	8,888,656,813	8,230,269,081	8,688,362,321	9,259,718,167	9,646,325,403
ARKANSAS	2,368,138,799	2,645,239,752	2,897,343,404	3,065,986,737	3,391,223,037	3,477,299,860
CALIFORNIA	27,823,251,315	31,051,454,471	33,632,018,885	35,494,399,519	37,109,304,218	38,372,424,979
COLORADO	3,577,298,353	4,059,034,339	4,446,716,327	4,757,142,221	5,125,428,962	5,504,579,476
CONNECTICUT	5,211,723,356	5,649,698,283	6,098,941,389	6,270,121,451	6,817,767,735	6,794,642,153
DELAWARE	1,130,194,168	1,288,639,263	1,489,735,998	1,664,893,594	1,896,326,875	2,067,690,305
DISTRICT OF COLUMBIA	611,120,542	661,182,787	674,789,976	687,813,898	744,816,178	698,301,272
FLORIDA	24,623,326,603	31,030,599,970	31,653,225,173	35,655,659,546	41,181,129,277	36,706,073,028
GEORGIA	7,184,708,141	8,223,744,728	8,588,262,074	9,310,706,995	10,933,338,776	11,403,383,594
GUAM	18,758,276	20,982,416	19,897,614	21,384,039	22,432,061	24,743,355
HAWAII	1,012,008,828	1,063,061,055	1,140,787,452	1,209,415,146	1,264,981,191	1,309,608,628
IDAHO	1,051,818,160	1,185,314,432	1,332,516,897	1,481,394,875	1,684,331,844	1,795,311,503
ILLINOIS	8,044,569,691	8,435,205,774	9,005,029,724	9,289,164,995	10,073,144,081	10,275,685,156
INDIANA	6,642,536,454	7,546,272,112	8,204,338,740	8,904,641,325	9,700,241,982	10,166,814,448
IOWA	1,516,633,760	1,740,551,767	1,849,796,361	1,931,962,120	2,138,958,109	2,249,672,527
KANSAS	2,257,452,043	2,587,961,717	2,759,415,026	2,794,099,811	3,073,279,379	3,217,184,704
KENTUCKY	4,222,175,777	4,743,621,114	5,401,360,411	6,138,183,752	7,090,023,980	7,587,996,851
LOUISIANA	5,551,639,885	6,532,316,613	5,657,050,892	5,759,702,746	5,932,646,974	6,193,648,903
MAINE	2,313,969,175	2,655,356,394	3,069,734,798	3,332,002,662	3,480,875,589	3,331,892,273
MARYLAND	7,221,534,450	7,910,931,700	8,621,895,264	9,681,199,069	11,049,195,957	11,401,414,171
MASSACHUSETTS	7,826,882,656	8,811,564,680	9,506,607,242	10,331,178,509	11,092,528,965	11,407,149,495
MICHIGAN	9,221,946,729	10,205,899,440	11,363,405,103	12,397,611,415	13,636,171,876	14,108,062,774
MINNESOTA	2,734,764,245	3,006,838,445	3,533,969,991	3,627,757,373	4,033,201,676	4,119,505,977
MISSISSIPPI	1,941,701,478	2,605,409,680	2,519,278,224	2,797,542,274	3,152,486,645	3,288,012,639
MISSOURI	5,088,082,996	5,240,697,423	5,686,126,475	6,013,433,881	6,849,779,206	7,419,864,333

Source: ARCOS, Barclays Research

FIGURE 30

Total Shipment in MME – By State (continued)

State	2006	2007	2008	2009	2010	2011
MONTANA	919,229,837	1,017,014,261	1,107,612,431	1,145,095,942	1,246,265,652	1,219,895,944
NEBRASKA	905,001,060	986,881,482	1,066,905,599	1,132,240,507	1,223,777,221	1,264,050,315
NEVADA	3,653,738,378	4,123,853,066	4,306,492,663	4,465,360,719	4,721,995,832	4,902,531,179
NEW HAMPSHIRE	1,409,784,444	1,671,063,736	1,737,724,167	1,973,877,450	2,182,440,946	2,206,122,161
NEW JERSEY	8,764,285,625	9,648,265,374	10,349,562,444	11,370,358,897	12,272,589,464	12,749,205,587
NEW MEXICO	1,696,335,659	1,892,793,680	2,127,776,633	2,352,785,983	2,567,832,255	2,740,625,356
NEW YORK	19,099,916,101	21,027,270,108	22,521,558,313	24,567,647,684	26,249,677,553	26,698,406,189
NORTH CAROLINA	8,830,678,976	9,979,750,531	10,120,918,389	11,349,613,463	12,266,725,789	13,087,703,152
NORTH DAKOTA	346,618,441	413,360,500	488,503,601	469,213,804	489,055,820	512,778,464
OHIO	11,079,025,323	12,306,984,408	13,657,773,065	14,693,349,028	15,791,981,409	16,282,635,713
OKLAHOMA	3,815,952,908	4,397,153,832	4,885,781,433	5,172,568,749	5,662,652,809	5,981,819,075
OREGON	5,391,246,487	6,115,217,994	6,488,070,138	6,771,811,284	7,097,012,453	7,185,660,699
PENNSYLVANIA	14,183,094,419	16,012,450,485	18,165,552,513	20,080,961,813	21,908,881,454	22,183,226,002
PUERTO RICO	1,324,159,067	1,333,445,035	1,399,613,448	1,392,421,638	1,309,465,064	1,211,858,280
RHODE ISLAND	1,607,794,851	1,764,684,329	1,954,372,797	2,071,447,113	2,283,815,845	2,303,567,719
SOUTH CAROLINA	3,569,540,710	4,326,991,159	4,360,673,679	5,048,872,756	5,648,191,738	6,007,315,595
SOUTH DAKOTA	425,452,147	478,241,046	541,198,362	570,775,442	653,929,634	2,465,139,721
TENNESSEE	8,394,661,789	10,255,959,654	10,779,557,185	12,157,596,317	13,326,597,618	13,548,575,572
TEXAS	13,073,277,020	15,040,688,429	15,708,671,556	16,557,071,105	17,726,903,019	18,524,213,768
UTAH	2,820,435,683	3,162,462,189	3,440,576,374	3,579,205,182	3,787,732,273	3,932,238,740
VERMONT	759,629,373	905,674,115	1,058,324,211	1,173,533,653	1,237,243,357	1,199,141,741
VIRGIN ISLANDS	12,894,620	17,908,966	15,938,487	15,142,458	16,179,761	20,197,195
VIRGINIA	5,416,863,503	6,137,049,191	6,490,257,195	7,225,710,400	7,918,280,984	8,305,310,350
WASHINGTON	8,166,897,009	8,959,705,770	9,803,185,865	10,141,997,253	10,345,684,780	10,259,621,745
WEST VIRGINIA	2,936,075,233	3,131,454,026	3,399,579,864	3,750,960,497	3,981,694,191	4,147,352,670
WISCONSIN	4,631,327,828	10,444,871,704	5,802,322,145	6,261,265,528	6,722,783,709	6,864,326,834
WYOMING	359,157,203	392,499,814	442,998,212	469,254,741	498,811,119	507,690,032
Grand Total	**286,292,755,809**	**331,509,776,571**	**347,283,933,300**	**375,363,693,529**	**408,595,829,122**	**418,273,103,663**

Source: ARCOS, Barclays Research

FIGURE 30

Total Shipment in MME – By State (continued)

State	2012	2013	2014	2015	2016	2017
ALABAMA	9,501,097,817	9,930,523,708	9,987,835,362	10,117,394,480	9,751,139,168	9,177,861,151
ALASKA	938,333,880	948,169,702	974,436,447	1,018,292,268	989,059,363	988,537,774
AMERICAN SAMOA	744,605	838,348	626,023	568,557	788,833	452,825
ARIZONA	9,863,816,844	9,457,260,214	9,745,847,298	9,596,621,335	9,425,930,598	8,624,554,879
ARKANSAS	3,680,876,484	3,590,357,023	3,775,626,642	3,869,879,381	3,731,146,738	3,487,198,661
CALIFORNIA	38,585,252,290	37,352,022,698	36,828,564,312	36,038,313,916	33,320,297,208	31,182,635,060
COLORADO	5,805,316,090	5,523,540,077	5,493,852,869	5,527,652,245	5,297,671,489	5,042,804,434
CONNECTICUT	7,106,472,220	7,183,274,126	7,440,018,951	7,597,887,067	7,306,987,645	7,474,927,984
DELAWARE	2,040,352,210	1,988,504,294	2,023,167,829	2,070,514,999	2,029,262,930	2,090,704,562
DISTRICT OF COLUMBIA	705,804,357	702,375,712	738,133,410	743,897,072	744,350,181	774,175,162
FLORIDA	29,638,095,957	25,761,478,729	25,799,073,974	26,338,709,163	26,372,810,611	25,391,814,313
GEORGIA	11,679,568,903	11,660,702,957	11,695,650,255	12,001,709,539	11,800,605,333	11,526,087,762
GUAM	23,877,013	26,410,012	24,504,969	24,312,301	19,456,015	12,512,632
HAWAII	1,305,693,382	1,263,258,783	1,196,853,327	1,167,982,384	1,104,612,213	1,039,957,310
IDAHO	1,940,105,076	1,953,416,896	2,004,212,407	2,011,975,153	1,950,757,094	1,872,106,006
ILLINOIS	10,172,128,007	10,172,190,063	10,454,443,820	10,562,577,401	10,327,006,532	10,141,776,684
INDIANA	10,796,137,575	10,655,109,009	10,155,856,645	9,735,486,129	9,172,310,472	8,870,751,036
IOWA	2,296,867,032	2,131,573,254	2,144,085,079	2,108,966,716	2,007,937,715	1,851,789,703
KANSAS	3,390,887,904	3,367,472,252	3,454,796,034	3,413,318,642	3,192,804,268	2,974,104,660
KENTUCKY	7,920,134,476	7,924,869,453	8,690,049,852	8,871,823,115	8,671,611,406	8,741,984,037
LOUISIANA	6,463,649,510	6,383,188,310	6,469,081,841	6,369,913,285	6,360,763,225	6,260,168,157
MAINE	3,301,255,702	3,162,681,963	3,164,631,054	3,183,564,285	3,013,057,963	2,831,749,874
MARYLAND	11,515,727,714	11,694,655,382	11,966,323,172	12,467,197,344	12,419,669,830	12,620,612,159
MASSACHUSETTS	11,744,765,175	12,054,345,150	12,153,550,559	12,334,050,244	12,047,731,892	12,317,299,411
MICHIGAN	14,381,751,286	14,360,688,240	14,708,031,177	14,836,540,888	14,277,918,335	13,842,243,709
MINNESOTA	4,530,179,152	4,718,078,051	4,898,732,521	4,893,070,316	4,713,168,782	4,465,377,994
MISSISSIPPI	3,463,143,551	3,458,854,405	3,562,307,079	3,631,820,840	3,604,819,408	3,467,200,696
MISSOURI	7,687,599,057	7,514,764,796	7,588,556,896	7,404,864,161	7,141,760,499	6,768,699,908

Source: ARCOS, Barclays Research

FIGURE 30

Total Shipment in MME – By State (continued)

State	2012	2013	2014	2015	2016	2017
MONTANA	1,306,967,592	1,309,358,013	1,296,602,975	1,246,894,867	1,186,205,978	1,136,180,972
NEBRASKA	1,289,384,016	1,266,078,972	1,280,568,055	1,302,935,681	1,294,270,539	1,212,285,781
NEVADA	4,863,039,738	4,370,828,713	4,229,483,505	4,172,154,472	4,038,032,642	3,695,972,332
NEW HAMPSHIRE	2,415,122,790	2,490,984,528	2,674,449,005	2,766,912,939	2,665,904,384	2,672,846,619
NEW JERSEY	12,626,117,600	12,731,644,388	12,957,609,147	12,951,586,092	12,534,683,511	11,871,905,136
NEW MEXICO	2,831,893,377	2,782,440,101	3,101,979,083	3,311,577,860	3,307,871,117	3,357,806,580
NEW YORK	26,338,508,171	25,804,002,857	25,954,944,197	26,413,170,768	25,562,234,870	24,925,109,996
NORTH CAROLINA	14,223,613,399	14,824,633,865	15,048,789,246	15,645,578,943	15,324,069,575	14,827,285,032
NORTH DAKOTA	543,901,253	551,779,936	572,929,075	562,595,510	502,551,548	473,928,761
OHIO	15,767,584,773	15,296,439,231	15,384,719,693	15,436,909,534	15,041,111,537	14,512,794,487
OKLAHOMA	5,797,585,352	6,343,205,852	6,559,834,295	6,477,925,721	6,311,169,726	6,104,880,457
OREGON	7,110,543,986	6,891,385,433	6,797,351,534	6,527,977,561	5,941,424,420	5,591,942,217
PENNSYLVANIA	23,400,140,018	23,241,439,528	23,895,145,592	24,213,649,030	23,800,504,122	23,314,517,292
PUERTO RICO	1,110,017,227	1,129,497,120	1,102,577,356	1,188,205,369	1,147,904,847	1,145,084,169
RHODE ISLAND	2,391,947,148	2,486,869,804	2,498,243,230	2,668,875,843	2,735,307,048	2,774,706,824
SOUTH CAROLINA	6,607,193,383	6,741,653,276	6,759,997,530	6,652,101,101	6,510,723,361	6,265,929,704
SOUTH DAKOTA	626,148,779	638,864,402	698,885,050	679,654,918	587,353,328	504,963,362
TENNESSEE	14,485,579,159	14,185,980,831	14,251,402,706	13,085,632,873	12,184,304,227	11,596,049,089
TEXAS	18,966,849,976	19,484,146,581	19,152,670,872	18,849,737,022	18,337,396,874	17,424,540,850
UTAH	4,154,844,855	4,241,391,542	4,292,606,854	4,334,545,062	4,228,843,505	4,003,582,441
VERMONT	1,236,262,820	1,314,556,421	1,444,605,009	1,562,234,294	1,573,803,493	1,669,155,594
VIRGIN ISLANDS	17,443,771	17,152,016	15,927,216	16,388,561	14,059,677	12,973,438
VIRGINIA	8,812,902,051	9,014,570,732	9,222,985,254	9,344,456,048	9,205,782,942	8,724,799,660
WASHINGTON	9,940,195,608	9,724,334,113	9,758,834,205	9,989,115,398	9,513,678,041	9,204,732,051
WEST VIRGINIA	4,409,994,825	4,356,603,646	4,495,805,577	4,395,028,511	4,048,466,806	3,797,301,717
WISCONSIN	7,126,555,554	7,109,412,749	7,200,078,174	7,234,265,361	6,686,384,151	6,147,384,565
WYOMING	560,662,077	570,617,952	584,261,195	589,592,973	555,022,650	524,188,350
Grand Total	**419,440,632,555**	**413,860,476,194**	**418,372,135,420**	**419,558,605,524**	**405,634,500,652**	**391,332,936,008**

Source: ARCOS, Barclays Research

FIGURE 31

Total Shipment in MME - By Activity

DRUG NAME	DRUG CODE	BUSINESS ACTIVITY	2006	2007	2008	2009	2010	2011
BUPRENORPHINE	**9064**	A - PHARMACIES	8,052,080,700	14,305,302,300	24,939,762,000	34,700,485,500	42,478,391,700	49,168,864,200
		B - HOSPITALS	388,918,500	558,387,000	840,946,500	1,034,615,400	1,406,616,300	1,696,434,600
		C - PRACTITIONERS	171,818,400	275,544,300	592,465,800	876,544,200	683,142,900	146,822,400
		D - TEACHING INSTITUTIONS	214,800	184,800	337,200	333,900	270,900	301,800
		M - MID-LEVEL PRACTITIONERS	20,400	44,400	142,800	399,900	375,000	30,600
		N-U NARCOTIC TREATMENT PROGRAMS	67,567,200	110,011,800	182,694,900	167,587,500	204,921,000	248,015,400
CODEINE	**9050**	A - PHARMACIES	2,543,316,530	2,562,560,097	2,465,917,548	2,310,511,007	2,202,356,747	2,311,380,051
		B - HOSPITALS	238,724,499	238,227,572	225,373,772	219,553,307	201,673,193	195,668,118
		C - PRACTITIONERS	32,059,089	24,894,132	23,634,266	21,425,826	16,870,638	14,971,829
		D - TEACHING INSTITUTIONS	64,073	12,692	27,320	22,211	35,675	42,470
		M - MID-LEVEL PRACTITIONERS	272,694	353,321	324,090	348,207	330,153	287,100
		N-U NARCOTIC TREATMENT PROGRAMS		1,491				
DIHYDROCODEINE	**9120**	A - PHARMACIES	38,515,960	34,483,815	28,483,163	20,330,073	18,159,810	18,432,430
		B - HOSPITALS	225,163	188,513	195,823	163,465	95,678	107,798
		C - PRACTITIONERS	2,389,463	851,870	149,973	1,084,913	567,158	641,610
		D - TEACHING INSTITUTIONS	80		268			
		M - MID-LEVEL PRACTITIONERS	114,210	23,408	2,195	137,795	85,050	74,245
		N-U NARCOTIC TREATMENT PROGRAMS						118
FENTANYL BASE	**9801**	A - PHARMACIES	49,416,872,700	53,343,986,800	55,720,826,200	55,008,051,800	59,214,587,900	56,364,122,100
		B - HOSPITALS	5,992,434,500	6,611,090,200	6,346,884,700	6,142,461,000	9,174,571,900	8,547,991,400
		C - PRACTITIONERS	314,299,700	275,489,500	402,118,600	345,900,100	376,572,300	322,205,000
		D - TEACHING INSTITUTIONS	2,005,900	2,549,300	2,371,200	1,937,000	3,199,300	2,519,400
		M - MID-LEVEL PRACTITIONERS	1,264,900	1,040,000	1,380,600	1,566,500	1,492,400	1,450,800
		N-U NARCOTIC TREATMENT PROGRAMS	9,100	106,600	48,100	62,400	14,300	
HYDROCODONE	**9193**	A - PHARMACIES	28,229,628,270	34,074,711,370	33,780,483,480	35,813,667,970	37,083,507,950	40,341,048,430
		B - HOSPITALS	1,242,764,420	1,438,980,630	1,451,288,240	1,595,481,320	1,654,317,030	1,728,630,580
		C - PRACTITIONERS	376,082,640	348,975,100	315,682,130	339,615,570	352,466,620	321,956,060
		D - TEACHING INSTITUTIONS	391,220	141,470	343,920	309,890	545,350	164,170
		M - MID-LEVEL PRACTITIONERS	7,450,430	4,692,750	3,238,170	5,058,760	6,058,270	3,742,430
		N-U NARCOTIC TREATMENT PROGRAMS		300	11,770	1,510		

Source: ARCOS, Barclays Research

FIGURE 31

Total Shipment in MME - By Activity (continued)

DRUG NAME	DRUG CODE	BUSINESS ACTIVITY	2006	2007	2008	2009	2010	2011
HYDROMORPHONE	9150	A - PHARMACIES	2,777,567,400	3,196,894,000	3,679,993,080	4,194,233,120	4,434,123,520	5,141,045,680
		B - HOSPITALS	812,883,440	908,993,000	985,596,080	1,136,379,360	1,171,938,160	1,149,833,680
		C - PRACTITIONERS	16,027,640	19,914,400	36,214,400	27,649,120	25,435,240	31,323,680
		D - TEACHING INSTITUTIONS	168,360	209,480	195,600	150,440	156,960	175,920
		M - MID-LEVEL PRACTITIONERS	4,360	56,960	390,200	37,920	40,880	233,280
		N-U NARCOTIC TREATMENT PROGRAMS			15,400	18,080	13,280	3,560
LEVORPHANOL	9220L	A - PHARMACIES	27,780,170	30,799,010	26,771,250	27,270,430	4,785,550	5,946,930
		B - HOSPITALS	1,765,390	2,243,560	2,006,290	1,473,670	53,790	94,600
		C - PRACTITIONERS			8,910	24,310	15,400	660
MEPERIDINE (PETHIDINE)	9230	A - PHARMACIES	253,051,055	250,117,349	227,190,794	169,935,619	150,248,343	137,646,846
		B - HOSPITALS	152,169,599	132,369,165	108,173,511	91,219,230	74,732,926	62,086,876
		C - PRACTITIONERS	10,763,870	11,107,252	10,382,880	8,994,315	8,318,494	7,689,247
		D - TEACHING INSTITUTIONS	5,701	3,434	4,555	5,317	1,788	2,616
		M - MID-LEVEL PRACTITIONERS	13,091	20,495	17,135	23,138	15,164	21,362
		N-U NARCOTIC TREATMENT PROGRAMS	174	217	828			
METHADONE	9250B	A - PHARMACIES	47,891,903,280	52,531,898,720	48,013,834,640	49,025,530,800	48,549,491,840	47,235,429,760
		B - HOSPITALS	4,673,154,560	4,861,231,520	4,900,468,480	4,877,306,640	5,007,877,920	4,564,771,280
		C - PRACTITIONERS	408,371,360	431,937,360	327,480,400	330,658,560	201,461,040	63,273,600
		D - TEACHING INSTITUTIONS	70,720	681,440	251,120	453,680	583,120	805,760
		M - MID-LEVEL PRACTITIONERS			21,440	207,520	450,800	271,920
		N-U NARCOTIC TREATMENT PROGRAMS	58,764,982,560	61,107,640,080	65,260,821,440	67,317,581,120	69,968,451,200	70,616,245,440
MORPHINE	9300	A - PHARMACIES	14,679,305,260	16,104,845,600	17,606,152,460	19,095,363,240	19,575,636,370	20,495,644,730
		B - HOSPITALS	2,790,522,180	2,909,658,980	2,955,670,490	3,117,143,720	3,281,432,140	3,090,493,380
		C - PRACTITIONERS	36,843,810	36,253,990	47,184,980	58,165,220	57,910,140	59,046,000
		D - TEACHING INSTITUTIONS	170,740	181,140	231,480	149,000	156,020	176,500
		M - MID-LEVEL PRACTITIONERS	306,470	382,940	406,550	649,720	492,210	533,240
		N-U NARCOTIC TREATMENT PROGRAMS	6,010	103,240	65,370	11,460	13,620	18,950

Source: ARCOS, Barclays Research

FIGURE 31

Total Shipment in MME - By Activity (continued)

DRUG NAME	DRUG CODE	BUSINESS ACTIVITY	2006	2007	2008	2009	2010	2011
OPIUM POWDERED	9639	A - PHARMACIES	23,032,840	15,682,680	12,311,680	15,855,880	14,549,760	14,735,940
		B - HOSPITALS	23,177,720	13,760,040	19,770,400	19,013,130	19,811,080	21,043,080
		C - PRACTITIONERS	205,920	5,237,471,570	120,600	148,320	169,920	222,120
OXYCODONE	9143	A - PHARMACIES	51,948,384,165	64,146,208,260	68,691,477,945	78,051,157,320	89,495,061,210	90,726,330,525
		B - HOSPITALS	3,405,698,130	3,707,318,190	3,867,386,070	3,933,171,975	4,213,488,570	4,388,775,345
		C - PRACTITIONERS	196,873,155	347,692,605	900,444,120	1,654,140,720	1,828,906,395	232,442,325
		D - TEACHING INSTITUTIONS	350,715	12,930	133,140	14,115	18,825	12,375
		M - MID-LEVEL PRACTITIONERS	24,135	145,740	136,425	77,190	503,520	627,570
		N-U NARCOTIC TREATMENT PROGRAMS	4,020	112,935	41,295	24,885	2,010	14,115
OXYMORPHONE	9652	A - PHARMACIES	173,166,240	1,164,197,880	2,118,552,240	3,016,513,020	4,023,426,870	6,457,631,970
		B - HOSPITALS	1,290,810	7,154,280	17,227,950	24,207,270	36,506,760	52,481,640
		C - PRACTITIONERS	68,310	166,950	1,063,980	3,407,550	6,367,800	11,102,190
		D - TEACHING INSTITUTIONS	510	2,250	2,670	5,970	5,520	6,090
		M - MID-LEVEL PRACTITIONERS			30			16,050
REMIFENTANIL	9739	A - PHARMACIES	1,832,400	2,347,200	3,043,800	3,450,600	1,990,800	2,253,600
		B - HOSPITALS	98,190,000	114,033,600	150,350,400	154,537,200	156,745,800	198,732,600
		C - PRACTITIONERS	3,108,600	3,074,400	5,918,400	5,250,600	5,281,200	5,738,400
		D - TEACHING INSTITUTIONS	5,400	16,200	68,400	48,600	30,600	36,000
		M - MID-LEVEL PRACTITIONERS						
		N-U NARCOTIC TREATMENT PROGRAMS			7,200			
TAPENTADOL	9780	A - PHARMACIES				390,463,320	1,173,430,752	2,034,659,672
		B - HOSPITALS				3,087,200	12,749,188	25,680,888
		C - PRACTITIONERS				768,384	11,716,988	1,776,000
		D - TEACHING INSTITUTIONS					8,000	14,000
		M - MID-LEVEL PRACTITIONERS					57,480	4,000
Grand Total			**286,292,755,809**	**331,509,776,571**	**347,302,741,233**	**375,363,635,020**	**408,595,890,183**	**418,273,057,129**

Source: ARCOS, Barclays Research

FIGURE 31

Total Shipment in MME - By Activity (continued)

DRUG NAME	DRUG CODE	BUSINESS ACTIVITY	2012	2013	2014	2015	2016	2017
BUPRENORPHINE	**9064**	A - PHARMACIES	57,925,970,100	65,995,706,700	72,667,051,200	79,317,344,100	85,339,305,900	95,397,117,000
		B - HOSPITALS	1,876,389,000	2,033,810,700	2,129,991,900	2,237,590,500	2,538,965,700	2,928,477,300
		C - PRACTITIONERS	154,760,400	168,566,100	188,838,900	182,320,200	206,961,900	227,541,000
		D - TEACHING INSTITUTIONS	600,300	482,700	318,600	226,800	199,500	239,700
		M - MID-LEVEL PRACTITIONERS	141,300	356,700	356,700	414,600	216,000	513,000
		N-U NARCOTIC TREATMENT PROGRAMS	348,417,600	597,794,100	1,127,242,200	1,491,878,700	1,737,577,500	1,981,665,600
CODEINE	**9050**	A - PHARMACIES	2,127,351,807	1,937,159,307	2,017,000,292	2,632,140,977	2,490,383,595	2,314,121,966
		B - HOSPITALS	172,133,567	148,964,832	139,812,594	146,615,315	105,307,532	85,879,238
		C - PRACTITIONERS	13,824,009	12,257,319	12,796,148	16,612,377	17,564,037	22,065,327
		D - TEACHING INSTITUTIONS	41,997	32,880	55,770	82,908	201,486	333,012
		M - MID-LEVEL PRACTITIONERS	225,986	228,026	197,511	819,824	818,489	553,562
		N-U NARCOTIC TREATMENT PROGRAMS			597	795		3,315
DIHYDROCODEINE	**9120**	A - PHARMACIES	13,160,838	6,424,028	688,655	4,996,853	6,773,903	6,935,565
		B - HOSPITALS	73,455	34,328	5,608	15,488	15,223	32,403
		C - PRACTITIONERS	235,823	326,885	19,723	168,220	1,385,758	542,005
		D - TEACHING INSTITUTIONS			28			
		M - MID-LEVEL PRACTITIONERS	28,565	63,473	1,623	11,668	82,753	74,913
		N-U NARCOTIC TREATMENT PROGRAMS						
FENTANYL BASE	**9801**	A - PHARMACIES	56,055,811,500	52,490,530,300	52,675,138,100	50,313,909,100	45,551,654,200	37,177,918,700
		B - HOSPITALS	6,296,041,700	6,217,142,100	5,710,198,000	5,678,991,500	5,386,742,400	4,728,252,100
		C - PRACTITIONERS	354,487,900	498,477,200	382,785,000	323,261,900	334,613,500	278,765,500
		D - TEACHING INSTITUTIONS	2,134,600	3,608,800	2,380,300	2,455,700	2,124,200	2,054,000
		M - MID-LEVEL PRACTITIONERS	2,616,900	7,269,600	4,312,100	5,574,400	8,299,200	9,027,200
		N-U NARCOTIC TREATMENT PROGRAMS	6,500	1,300		98,800		
HYDROCODONE	**9193**	A - PHARMACIES	39,786,938,720	38,515,926,520	35,885,093,000	30,891,515,590	28,615,716,350	25,666,888,320
		B - HOSPITALS	1,777,995,400	1,660,048,150	1,777,385,630	1,890,137,820	1,681,992,770	1,404,591,660
		C - PRACTITIONERS	323,449,360	281,794,370	200,624,920	89,265,850	69,672,100	57,192,330
		D - TEACHING INSTITUTIONS	111,360	98,140	145,040	106,610	92,980	123,810
		M - MID-LEVEL PRACTITIONERS	9,061,260	8,821,210	4,971,980	1,182,580	1,110,650	794,270
		N-U NARCOTIC TREATMENT PROGRAMS				36,320		

Source: ARCOS, Barclays Research

FIGURE 31

Total Shipment in MME - By Activity (continued)

DRUG NAME	DRUG CODE	BUSINESS ACTIVITY	2012	2013	2014	2015	2016	2017
HYDROMORPHONE	**9150**	A - PHARMACIES	6,047,846,240	6,178,570,600	6,084,929,440	5,789,719,640	5,368,365,280	4,681,005,320
		B - HOSPITALS	1,198,986,160	1,149,057,720	1,104,820,840	1,065,863,160	964,618,120	903,928,320
		C - PRACTITIONERS	29,578,520	29,618,840	29,772,720	28,730,360	31,809,280	31,019,840
		D - TEACHING INSTITUTIONS	227,320	206,360	188,080	164,640	189,560	203,560
		M - MID-LEVEL PRACTITIONERS	351,160	350,760	362,400	300,920	264,120	202,760
		N-U NARCOTIC TREATMENT PROGRAMS	80					4,960
LEVORPHANOL	**9220L**	A - PHARMACIES	13,128,060	16,636,620	18,095,990	17,552,040	22,648,010	41,853,240
		B - HOSPITALS	654,610	1,263,020	1,482,470	1,195,260	250,140	171,380
		C - PRACTITIONERS	110		6,380	3,190		3,850
MEPERIDINE (PETHIDINE)	**9230**	A - PHARMACIES	115,552,712	97,892,854	81,205,077	70,273,960	58,260,156	45,185,454
		B - HOSPITALS	52,741,180	42,268,760	34,766,581	29,398,261	24,376,898	20,665,916
		C - PRACTITIONERS	7,311,115	7,729,116	5,189,681	4,961,068	4,418,526	3,960,026
		D - TEACHING INSTITUTIONS	3,596	1,961	1,112	2,180	1,525	381
		M - MID-LEVEL PRACTITIONERS	35,342	27,018	13,344	9,272	6,580	8,770
		N-U NARCOTIC TREATMENT PROGRAMS			109			43,575
METHADONE	**9250B**	A - PHARMACIES	44,367,545,360	38,862,182,960	35,790,232,560	31,517,028,320	26,977,693,120	21,925,130,960
		B - HOSPITALS	4,188,953,680	3,798,312,000	3,305,307,840	2,875,776,480	2,490,971,280	2,093,475,040
		C - PRACTITIONERS	35,469,120	23,730,240	19,784,240	16,985,040	17,956,880	16,671,920
		D - TEACHING INSTITUTIONS	905,840	851,440	1,207,040	1,122,640	1,201,360	1,026,640
		M - MID-LEVEL PRACTITIONERS	3,359,360	3,820,960	5,355,680	4,629,440	3,817,280	2,877,840
		N-U NARCOTIC TREATMENT PROGRAMS	72,755,212,800	76,327,873,680	81,188,183,520	87,687,578,160	86,716,537,600	93,492,519,760
MORPHINE	**9300**	A - PHARMACIES	21,157,437,960	20,234,199,010	19,603,645,530	18,857,379,240	17,287,250,610	15,050,790,730
		B - HOSPITALS	3,030,066,750	2,765,042,760	2,513,829,440	2,215,962,860	1,872,037,960	1,532,432,260
		C - PRACTITIONERS	52,915,560	39,257,080	31,470,740	25,425,010	23,782,920	20,123,590
		D - TEACHING INSTITUTIONS	187,630	139,640	177,090	144,680	149,140	133,810
		M - MID-LEVEL PRACTITIONERS	1,743,650	2,086,520	1,667,000	1,639,080	1,518,590	1,107,840
		N-U NARCOTIC TREATMENT PROGRAMS	7,510	3,440				

Source: ARCOS, Barclays Research

FIGURE 31

Total Shipment in MME - By Activity (continued)

DRUG NAME	DRUG CODE	BUSINESS ACTIVITY	2012	2013	2014	2015	2016	2017
OPIUM POWDERED	9639	A - PHARMACIES	13,397,560	12,448,080	12,722,760	12,723,120	12,119,400	10,634,400
		B - HOSPITALS	19,588,280	19,549,080	19,688,400	20,612,880	20,742,120	21,384,000
		C - PRACTITIONERS	218,520	216,720	298,440	330,480	371,520	419,760
OXYCODONE	9143	A - PHARMACIES	87,306,523,995	81,491,425,245	81,483,139,200	81,963,153,825	78,075,868,890	69,778,703,130
		B - HOSPITALS	4,475,920,545	4,463,782,035	4,381,049,385	4,322,587,800	3,971,136,180	3,457,385,460
		C - PRACTITIONERS	158,326,335	107,630,580	54,552,390	66,086,520	116,086,125	45,258,105
		D - TEACHING INSTITUTIONS	6,720	4,035			2,010	675
		M - MID-LEVEL PRACTITIONERS	2,747,115	3,616,410	4,929,210	3,751,035	3,744,240	3,173,085
		N-U NARCOTIC TREATMENT PROGRAMS	2,700					
OXYMORPHONE	9652	A - PHARMACIES	4,806,496,020	4,816,448,220	5,022,567,840	5,041,075,500	4,646,148,120	3,299,213,190
		B - HOSPITALS	44,600,010	46,392,060	47,027,220	47,863,290	43,217,490	29,872,080
		C - PRACTITIONERS	7,008,510	5,179,440	5,407,110	2,535,930	3,448,200	1,679,580
		D - TEACHING INSTITUTIONS	7,080	9,000	6,960	5,580	5,580	1,620
		M - MID-LEVEL PRACTITIONERS	176,160	109,200	125,520	49,530	46,950	41,760
REMIFENTANIL	9739	A - PHARMACIES	2,613,600	2,637,000	2,161,800	1,629,000	1,674,000	1,616,400
		B - HOSPITALS	200,809,800	213,402,600	226,157,400	250,997,400	275,450,400	289,600,200
		C - PRACTITIONERS	6,895,800	6,485,400	6,636,600	7,329,600	7,783,200	7,390,800
		D - TEACHING INSTITUTIONS	46,800	43,200	41,400	57,600	41,400	45,000
		M - MID-LEVEL PRACTITIONERS	1,800	7,200	10,800	5,400	32,400	7,200
		N-U NARCOTIC TREATMENT PROGRAMS						
TAPENTADOL	9780	A - PHARMACIES	2,581,305,800	2,466,263,400	2,320,822,200	2,342,591,600	2,451,927,000	2,198,795,200
		B - HOSPITALS	36,565,324	37,031,124	34,896,480	34,852,388	38,113,796	37,051,340
		C - PRACTITIONERS	1,691,688	664,524	705,844	700,636	589,840	363,000
		D - TEACHING INSTITUTIONS	12,000	5,200				
		M - MID-LEVEL PRACTITIONERS	36,000	46,000	44,000	8,000	44,000	44,000
Grand Total			419,967,229,532	413,860,444,878	418,372,097,979	419,558,567,507	405,634,495,419	391,338,930,521

Source: ARCOS, Barclays Research

FIGURE 32

Total Shipment in MME - By State and By Drug – 2006 to 2017

State	BUPRENORPHINE	CODEINE	DIHYDROCODEINE	FENTANYL BASE	HYDROCODONE	HYDROMORPHONE	LEVORPHANOL	MEPERIDINE (PETHIDINE)
ALABAMA	2.77%	1.26%	6.10%	1.78%	3.33%	0.99%	0.79%	4.99%
ALASKA	0.25%	0.22%	0.01%	0.27%	0.16%	0.24%	0.04%	0.39%
AMERICAN SAMOA	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
ARIZONA	1.11%	2.12%	0.88%	2.11%	1.58%	1.90%	1.25%	2.54%
ARKANSAS	0.55%	1.08%	3.22%	0.98%	1.56%	0.92%	0.18%	3.82%
CALIFORNIA	4.84%	14.61%	1.34%	9.91%	12.33%	12.81%	27.02%	6.91%
COLORADO	0.84%	0.90%	0.62%	1.56%	0.97%	2.08%	1.23%	1.10%
CONNECTICUT	2.05%	0.87%	0.08%	1.39%	0.40%	1.89%	0.68%	0.67%
DELAWARE	0.39%	0.30%	0.03%	0.37%	0.11%	0.57%	0.04%	0.12%
DISTRICT OF COLUMBIA	0.21%	0.37%	0.03%	0.11%	0.03%	0.19%	0.00%	0.11%
FLORIDA	5.55%	4.53%	8.43%	6.09%	5.30%	11.61%	2.23%	6.52%
GEORGIA	2.02%	1.90%	5.47%	2.92%	3.37%	2.00%	0.48%	5.95%
GUAM	0.00%	0.05%	0.00%	0.01%	0.00%	0.01%	0.00%	0.02%
HAWAII	0.23%	0.41%	0.03%	0.24%	0.25%	0.20%	0.08%	0.26%
IDAHO	0.38%	0.35%	0.17%	0.56%	0.66%	0.46%	0.01%	0.35%
ILLINOIS	1.63%	4.81%	2.85%	3.43%	3.76%	2.78%	1.65%	1.64%
INDIANA	2.34%	1.53%	1.52%	2.61%	3.15%	1.74%	5.74%	1.84%
IOWA	0.19%	0.67%	0.25%	0.95%	0.75%	0.92%	0.94%	0.67%
KANSAS	0.31%	0.99%	0.21%	1.11%	1.18%	1.03%	0.57%	1.00%
KENTUCKY	3.90%	1.30%	0.47%	1.49%	2.85%	0.90%	0.27%	1.73%
LOUISIANA	2.25%	0.96%	11.40%	1.31%	2.39%	1.00%	2.14%	4.22%
MAINE	1.27%	0.36%	0.02%	0.50%	0.31%	0.48%	0.14%	0.27%
MARYLAND	3.19%	1.81%	0.28%	1.75%	0.61%	2.54%	0.27%	1.47%
MASSACHUSETTS	5.52%	1.66%	0.15%	1.77%	0.61%	2.25%	4.58%	1.40%
MICHIGAN	3.50%	6.34%	0.34%	3.80%	4.91%	2.96%	0.56%	1.83%
MINNESOTA	0.82%	1.41%	0.33%	1.36%	0.71%	1.42%	0.38%	0.40%
MISSISSIPPI	1.32%	0.65%	8.02%	1.19%	1.63%	0.86%	0.08%	2.55%
MISSOURI	1.06%	1.78%	2.96%	2.38%	2.24%	1.87%	5.49%	2.10%

Source: ARCOS, Barclays Research

FIGURE 32

Total Shipment in MME - By State and By Drug – 2006 to 2017 (continued)

State	BUPRENORPHINE	CODEINE	DIHYDROCODEINE	FENTANYL BASE	HYDROCODONE	HYDROMORPHONE	LEVORPHANOL	MEPERIDINE (PETHIDINE)
MONTANA	0.29%	0.32%	0.03%	0.40%	0.33%	0.44%	0.14%	0.36%
NEBRASKA	0.14%	0.38%	0.83%	0.56%	0.41%	0.32%	0.43%	0.33%
NEVADA	0.43%	1.01%	0.51%	0.77%	1.80%	1.04%	1.13%	0.92%
NEW HAMPSHIRE	0.86%	0.28%	0.01%	0.49%	0.15%	0.55%	0.14%	0.41%
NEW JERSEY	3.78%	2.45%	0.48%	2.93%	0.75%	2.74%	10.24%	1.13%
NEW MEXICO	0.76%	0.62%	0.31%	0.55%	0.52%	0.44%	0.07%	0.96%
NEW YORK	6.82%	6.39%	0.47%	5.56%	3.16%	6.09%	5.90%	2.68%
NORTH CAROLINA	2.83%	1.43%	2.54%	3.48%	2.76%	2.64%	3.48%	3.66%
NORTH DAKOTA	0.10%	0.19%	0.29%	0.28%	0.16%	0.21%	0.01%	0.14%
OHIO	5.55%	3.67%	4.34%	4.40%	2.98%	3.20%	1.19%	3.17%
OKLAHOMA	1.15%	1.46%	5.15%	1.77%	2.41%	1.04%	0.11%	3.90%
OREGON	1.06%	1.15%	0.05%	1.44%	1.33%	1.60%	3.16%	0.73%
PENNSYLVANIA	7.53%	4.14%	1.85%	6.09%	2.67%	4.24%	1.61%	2.19%
PUERTO RICO	0.25%	0.29%	1.17%	0.15%	0.03%	0.02%	0.02%	1.62%
RHODE ISLAND	0.94%	0.28%	0.01%	0.28%	0.22%	0.31%	0.12%	0.20%
SOUTH CAROLINA	1.21%	2.21%	1.79%	1.46%	2.69%	1.37%	0.42%	3.63%
SOUTH DAKOTA	0.05%	0.26%	0.26%	0.61%	0.19%	0.19%	0.04%	0.26%
TENNESSEE	4.17%	3.56%	6.38%	2.72%	5.06%	2.02%	0.34%	5.27%
TEXAS	3.70%	9.82%	15.38%	5.92%	10.43%	5.70%	2.76%	6.06%
UTAH	1.30%	0.48%	0.87%	0.89%	0.82%	0.61%	1.68%	0.82%
VERMONT	0.79%	0.14%	0.00%	0.25%	0.08%	0.36%	0.46%	0.13%
VIRGIN ISLANDS	0.00%	0.02%	0.00%	0.01%	0.01%	0.01%	0.00%	0.04%
VIRGINIA	2.29%	1.71%	1.19%	2.20%	1.71%	3.59%	2.95%	3.26%
WASHINGTON	2.16%	1.93%	0.03%	1.91%	1.76%	2.92%	3.85%	1.74%
WEST VIRGINIA	1.78%	0.67%	0.67%	0.75%	1.12%	0.54%	0.05%	0.48%
WISCONSIN	1.42%	1.72%	0.08%	2.00%	1.15%	1.09%	2.63%	0.82%
WYOMING	0.13%	0.14%	0.09%	0.17%	0.15%	0.15%	0.25%	0.23%
Grand Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Source: ARCOS, Barclays Research

FIGURE 32

Total Shipment in MME - By State and By Drug – 2006 to 2017 (continued)

State	METHADONE	MORPHINE	OPIUM POWDERED	OXYCODONE	OXYMORPHONE	REMIFENTANIL	TAPENTADOL
ALABAMA	2.34%	1.69%	0.09%	1.60%	1.92%	0.99%	4.01%
ALASKA	0.22%	0.28%	0.04%	0.24%	0.07%	0.70%	0.13%
AMERICAN SAMOA	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
ARIZONA	2.21%	4.24%	0.19%	3.46%	2.05%	0.91%	1.96%
ARKANSAS	0.63%	1.00%	0.07%	0.97%	0.52%	0.42%	1.69%
CALIFORNIA	9.87%	11.85%	0.38%	7.35%	7.00%	7.62%	8.21%
COLORADO	1.01%	1.84%	0.17%	1.78%	1.60%	1.64%	1.64%
CONNECTICUT	2.48%	0.94%	0.08%	1.59%	1.25%	1.45%	0.91%
DELAWARE	0.53%	0.44%	0.02%	0.68%	0.56%	1.08%	0.45%
DISTRICT OF COLUMBIA	0.31%	0.11%	0.01%	0.13%	0.04%	0.25%	0.07%
FLORIDA	7.84%	7.94%	0.38%	11.35%	6.65%	5.91%	8.13%
GEORGIA	2.82%	2.38%	0.18%	2.80%	1.93%	0.99%	4.35%
GUAM	0.00%	0.03%	0.00%	0.01%	0.00%	0.02%	0.00%
HAWAII	0.29%	0.60%	0.02%	0.37%	0.27%	0.30%	0.15%
IDAHO	0.36%	0.57%	0.05%	0.38%	0.37%	0.52%	0.29%
ILLINOIS	3.11%	2.19%	0.18%	1.11%	1.75%	3.77%	2.66%
INDIANA	2.54%	2.30%	0.21%	1.77%	2.63%	2.70%	2.65%
IOWA	0.36%	0.77%	0.09%	0.45%	0.39%	0.99%	0.81%
KANSAS	0.66%	0.97%	0.17%	0.83%	0.81%	0.53%	0.69%
KENTUCKY	1.21%	1.16%	0.20%	1.54%	1.56%	1.11%	1.31%
LOUISIANA	1.45%	1.19%	0.12%	1.37%	1.93%	0.72%	1.14%
MAINE	1.09%	0.52%	0.04%	0.61%	0.35%	0.39%	0.16%
MARYLAND	4.08%	1.94%	0.06%	2.59%	2.28%	1.71%	2.30%
MASSACHUSETTS	3.48%	1.74%	0.10%	2.34%	0.86%	5.05%	1.14%
MICHIGAN	3.26%	4.16%	0.29%	2.30%	4.38%	2.28%	1.59%
MINNESOTA	1.12%	1.05%	0.36%	1.11%	0.17%	1.58%	0.33%
MISSISSIPPI	0.25%	0.81%	0.04%	0.63%	1.04%	0.23%	0.96%
MISSOURI	1.06%	2.21%	0.30%	2.36%	1.77%	1.28%	1.98%

Source: ARCOS, Barclays Research

FIGURE 32

Total Shipment in MME - By State and By Drug – 2006 to 2017 (continued)

State	METHADONE	MORPHINE	OPIUM POWDERED	OXYCODONE	OXYMORPHONE	REMIFENTANIL	TAPENTADOL
MONTANA	0.21%	0.48%	0.03%	0.34%	0.14%	0.28%	0.18%
NEBRASKA	0.22%	0.39%	0.11%	0.30%	0.32%	0.36%	0.66%
NEVADA	1.08%	1.46%	0.04%	1.47%	1.61%	0.19%	0.90%
NEW HAMPSHIRE	0.66%	0.45%	0.03%	0.58%	0.32%	0.86%	0.37%
NEW JERSEY	2.89%	1.86%	0.10%	4.22%	2.50%	2.66%	3.54%
NEW MEXICO	0.74%	0.75%	0.04%	0.78%	0.51%	0.28%	0.27%
NEW YORK	8.46%	3.73%	0.17%	5.67%	7.04%	8.92%	7.92%
NORTH CAROLINA	3.37%	2.72%	0.20%	3.90%	7.79%	3.92%	6.06%
NORTH DAKOTA	0.06%	0.16%	0.04%	0.12%	0.05%	0.07%	0.17%
OHIO	2.32%	3.46%	0.46%	4.68%	5.22%	5.53%	5.35%
OKLAHOMA	1.01%	2.11%	0.07%	1.51%	1.93%	0.75%	1.51%
OREGON	2.17%	2.44%	0.15%	1.61%	0.77%	0.75%	0.46%
PENNSYLVANIA	4.88%	5.14%	0.32%	6.03%	6.65%	7.94%	4.58%
PUERTO RICO	0.73%	0.06%	0.00%	0.12%	0.01%	0.00%	0.13%
RHODE ISLAND	0.94%	0.26%	0.02%	0.39%	0.17%	0.08%	0.16%
SOUTH CAROLINA	1.19%	1.35%	0.13%	1.55%	1.63%	1.03%	2.53%
SOUTH DAKOTA	0.07%	0.23%	0.04%	0.16%	0.23%	0.12%	0.39%
TENNESSEE	1.82%	4.56%	0.27%	3.64%	7.34%	1.66%	2.06%
TEXAS	3.85%	4.44%	0.41%	2.15%	4.17%	7.00%	5.65%
UTAH	0.83%	1.06%	0.05%	1.20%	1.01%	4.14%	0.92%
VERMONT	0.33%	0.26%	0.04%	0.20%	0.11%	0.10%	0.08%
VIRGIN ISLANDS	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
VIRGINIA	1.78%	1.90%	0.14%	2.28%	2.94%	1.56%	3.44%
WASHINGTON	3.21%	2.89%	0.24%	2.41%	1.13%	3.11%	1.31%
WEST VIRGINIA	0.93%	0.66%	0.08%	0.89%	1.27%	1.90%	0.46%
WISCONSIN	1.60%	2.07%	92.92%	1.90%	0.83%	1.49%	1.01%
WYOMING	0.06%	0.21%	0.02%	0.17%	0.12%	0.15%	0.15%
Grand Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Source: ARCOS, Barclays Research

FIGURE 33
Opioid Impact

Location	2016 Opioid Misuse	2016 Opioid Use Disorder	2016 Medicare Part D Opioid Prescribing Rates	2016 Medicare Part D Long-Acting Opioid Prescribing Rate
United States	12,258,000	2,259,000	5.32%	12.68%
Alabama	218,000	52,000	7.44%	9.85%
Alaska	30,000	8,000	6.71%	18.98%
Arizona	271,000	71,000	6.49%	16.04%
Arkansas	120,000	23,000	6.35%	9.69%
California	1,620,000	226,000	4.99%	12.06%
Colorado	259,000	46,000	6.99%	15.58%
Connecticut	166,000	41,000	4.04%	16.38%
Delaware	40,000	11,000	5.92%	18.92%
District of Columbia	27,000	1,000	3.89%	9.95%
Florida	700,000	121,000	5.17%	14.10%
Georgia	337,000	61,000	5.92%	10.41%
Hawaii	54,000	6,000	3.74%	13.72%
Idaho	69,000	13,000	7.23%	16.55%
Illinois	426,000	76,000	4.59%	10.19%
Indiana	282,000	52,000	6.07%	12.12%
Iowa	85,000	11,000	4.47%	13.77%
Kansas	102,000	11,000	5.85%	14.56%
Kentucky	194,000	62,000	5.48%	8.34%
Louisiana	176,000	41,000	5.76%	8.55%
Maine	35,000	10,000	5.50%	18.51%
Maryland	217,000	51,000	5.69%	17.50%
Massachusetts	218,000	55,000	3.81%	15.15%
Michigan	434,000	82,000	6.65%	12.37%
Minnesota	195,000	28,000	4.73%	14.08%
Mississippi	112,000	26,000	5.95%	8.47%
Missouri	221,000	52,000	5.51%	12.14%

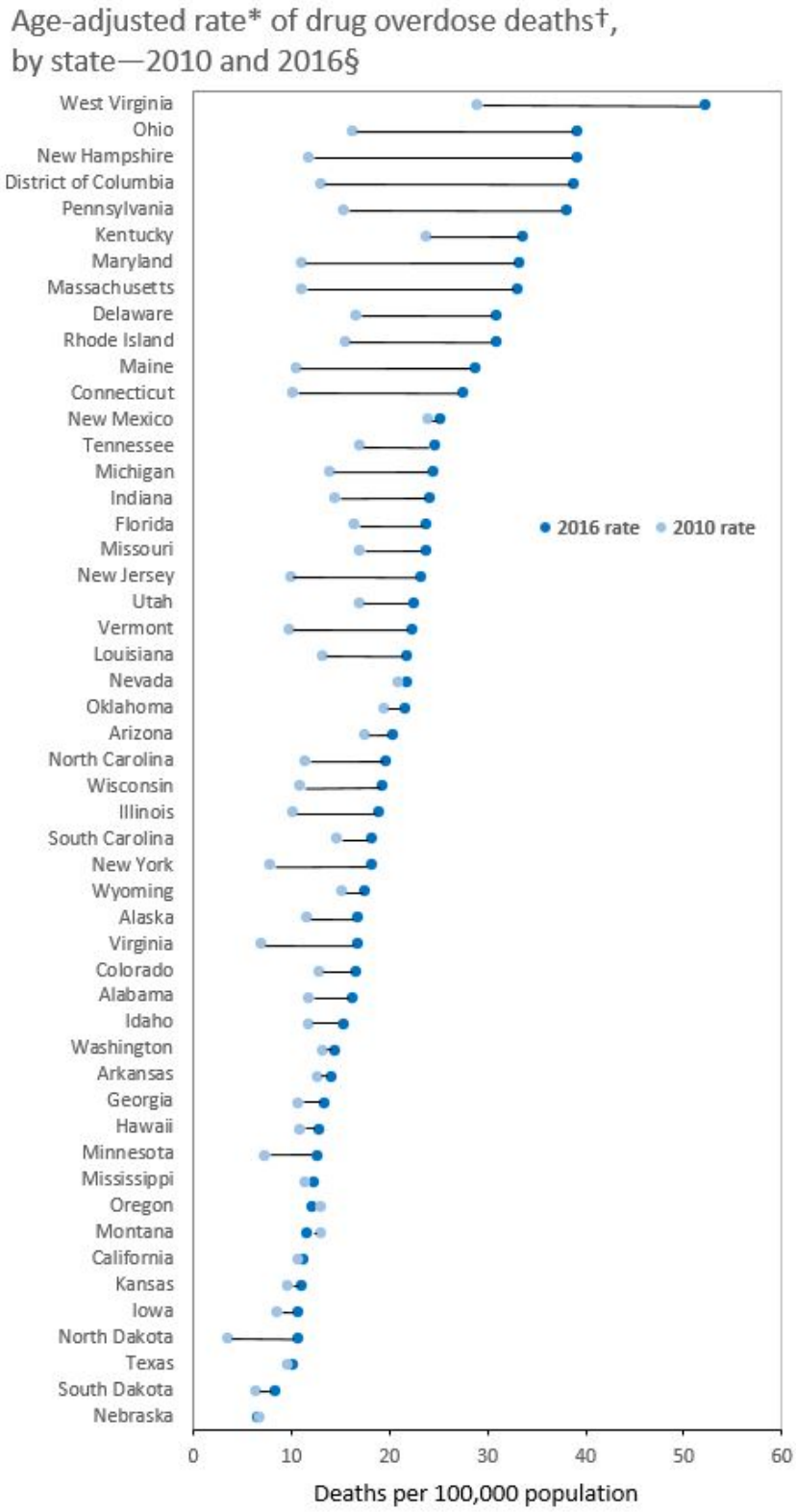
Source: KFF, CMS, Barclays Research

FIGURE 33
Opioid Impact (continued)

Location	2016 Opioid Misuse	2016 Opioid Use Disorder	2016 Medicare Part D Opioid Prescribing Rates	2016 Medicare Part D Long-Acting Opioid Prescribing Rate
Montana	42,000	7,000	6.27%	16.45%
Nebraska	56,000	7,000	4.65%	13.98%
Nevada	143,000	21,000	7.42%	14.30%
New Hampshire	60,000	17,000	5.02%	20.34%
New Jersey	274,000	62,000	3.99%	16.28%
New Mexico	72,000	12,000	6.15%	11.86%
New York	640,000	105,000	2.93%	14.12%
North Carolina	404,000	74,000	5.91%	13.26%
North Dakota	23,000	5,000	4.16%	16.78%
Ohio	455,000	83,000	5.02%	10.28%
Oklahoma	137,000	15,000	7.27%	14.11%
Oregon	204,000	35,000	6.88%	16.03%
Pennsylvania	517,000	91,000	4.66%	15.43%
Rhode Island	47,000	9,000	3.46%	11.53%
South Carolina	187,000	44,000	5.90%	10.02%
South Dakota	28,000	5,000	5.01%	16.68%
Tennessee	270,000	62,000	6.94%	12.97%
Texas	1,026,000	149,000	5.43%	8.84%
Utah	120,000	24,000	7.40%	14.76%
Vermont	29,000	7,000	5.35%	22.00%
Virginia	279,000	48,000	5.28%	11.34%
Washington	400,000	80,000	6.62%	15.93%
West Virginia	61,000	19,000	5.25%	8.49%
Wisconsin	159,000	36,000	5.52%	16.61%
Wyoming	18,000	3,000	5.85%	14.48%

Source: KFF, CMS, Barclays Research

FIGURE 34
Opioid Impact (continued)



Source: CDC.gov

FIGURE 35
ENDP Script Volume

Drug Name	1999	2000	2001	2002	2003	2004	2005	2006	2007
Endocet	45.82%	36.70%	42.89%	45.41%	46.20%	62.66%	47.36%	51.17%	62.37%
Endocodone	0.06%	0.08%	0.21%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Endodan	3.08%	4.27%	3.98%	3.36%	1.91%	1.60%	0.31%	0.00%	0.00%
Hyeodan	8.20%	0.64%	0.49%	0.31%	0.27%	0.08%	0.06%	0.05%	0.17%
Hyeodan Syrup (Pint)	0.53%	0.43%	0.22%	0.23%	0.15%	0.11%	0.09%	0.09%	0.09%
Hycomine	0.20%	0.25%	0.15%	0.10%	0.11%	0.08%	0.01%	0.00%	0.00%
Hycomine PED Syrup (Pint)	0.22%	0.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hycomine Syrup (Pint)	0.27%	0.12%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hyeotuss Syrum (Pint)	0.46%	0.36%	0.16%	0.15%	0.10%	0.11%	0.09%	0.09%	0.12%
Hydro/APAP	2.41%	1.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hydroporphone	1.03%	0.83%	0.74%	0.77%	0.00%	0.73%	0.11%	0.00%	0.00%
Morphine Sulfate ER	4.62%	8.07%	10.48%	15.36%	16.05%	14.19%	13.82%	12.77%	17.90%
Numorphan AMP (x10)	0.05%	0.04%	0.00%	0.00%	0.01%	0.02%	0.02%	0.02%	0.01%
Numorphan Suppositories Pkg of 6	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Numprphan (Vial)	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Opana	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.30%	1.46%
Opana ER	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.65%	3.46%
Opana Injection (x10)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%
Opana IR	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Oxycodone APAP	0.00%	0.03%	0.10%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%
Oxycodone ER	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	20.93%	21.46%	0.00%
Oxymorphone Hydrochloride	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Percocet	28.48%	39.93%	35.28%	32.02%	33.20%	18.72%	15.77%	12.30%	13.47%
Percodan	2.46%	2.14%	1.08%	0.82%	0.62%	0.52%	0.45%	0.26%	0.00%
Percolone	0.41%	0.58%	0.66%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%
Zydone	1.68%	4.32%	3.57%	1.42%	1.39%	1.18%	0.99%	0.84%	0.90%
TOTAL	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

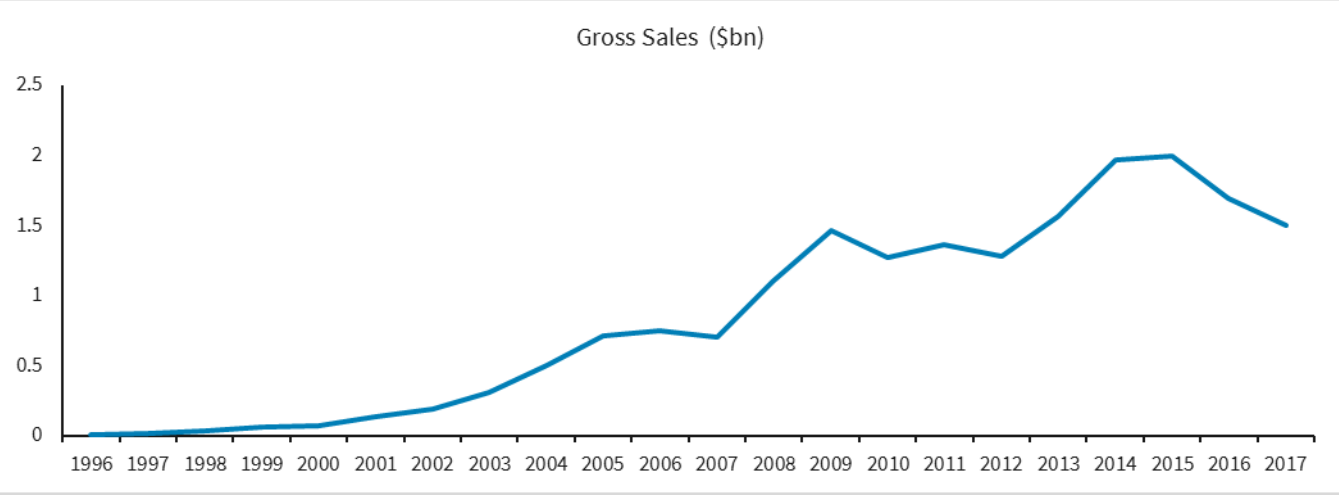
Source: MDL 2804, Barclays Research

FIGURE 35
ENDP Script Volume (continued)

Drug Name	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017 (June)
Endocet	62.01%	64.12%	65.10%	57.79%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Endocodone	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Endodan	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hyeodan	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hyeodan Syrup (Pint)	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hycomine	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hycomine PED Syrup (Pint)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hycomine Syrup (Pint)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hyeotuss Syrum (Pint)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hydro/APAP	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hydroporphone	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Morphine Sulfate ER	16.62%	19.34%	17.62%	18.81%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Numorphan AMP (x10)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Numorphan Suppositories Pkg of 6	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Numprphan (Vial)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Opana	2.43%	2.41%	2.42%	1.02%	0.18%	0.74%	0.36%	0.00%	0.00%	0.00%
Opana ER	6.28%	5.88%	8.42%	15.44%	72.96%	73.24%	88.46%	73.64%	75.05%	74.27%
Opana Injection (x10)	0.03%	0.02%	0.02%	0.03%	0.17%	0.19%	0.25%	0.28%	0.28%	0.12%
Opana IR	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.15%	1.03%	1.09%
Oxycodone APAP	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Oxycodone ER	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Oxymorphone Hydrochloride	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Percocet	11.79%	7.84%	6.06%	6.51%	25.16%	25.54%	10.93%	24.93%	23.64%	24.53%
Percodan	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
Percolone	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Zydone	0.79%	0.38%	0.37%	0.38%	1.52%	0.31%	0.00%	0.00%	0.00%	0.00%
TOTAL	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Source: MDL 2804, Barclays Research

FIGURE 36
MNK Sales – IMS based



Source: MDL 2804, Barclays Research

Summary of Ratings

Bloomberg Barclays U.S. High Yield 2% Issuer Capped Credit Index		
	Old	New
U.S. HY Healthcare	Market Weight	Market Weight
TEVA 0 1/2 07/28/22	Market Weight	Market Weight
TEVA 0 3/8 07/25/20	Market Weight	Market Weight
TEVA 1 07/28/25	Underweight	Underweight
TEVA 1 1/4 03/31/23	Underweight	Underweight
TEVA 1 1/8 10/15/24	Underweight	Underweight
TEVA 1 5/8 10/15/28	Underweight	Underweight
TEVA 1 7/8 03/31/27	Underweight	Underweight
TEVA 2 1/4 03/18/20	Market Weight	Market Weight
TEVA 2.2 07/21/21	Overweight	Overweight
TEVA 2.8 07/21/23	Underweight	Underweight
TEVA 2.95 12/18/22	Overweight	Overweight
TEVA 3.15 10/01/26	Underweight	Underweight
TEVA 3.65 11/10/2021	Overweight	Overweight
TEVA 3.65 11/10/2021	Overweight	Overweight
TEVA 4.1 10/01/46	Underweight	Underweight
TEVA 6 04/15/24	Underweight	Underweight
TEVA 6 3/4 03/01/28	Underweight	Underweight
TEVA 6.15 02/01/36	Underweight	Underweight
U.S. HY Pharmaceuticals	Market Weight	Market Weight
ENDP 5 7/8 10/15/24	Overweight	Overweight
ENDP 6 02/01/25	Overweight	Overweight
ENDP 6 07/15/23	Overweight	Overweight
ENDP 7 1/2 04/01/27	Overweight	Overweight
MNK 4 3/4 04/15/23	Underweight	Underweight
MNK 4 7/8 04/15/20	Overweight	Overweight
MNK 5 1/2 04/15/25	Underweight	Underweight
MNK 5 3/4 08/01/22	Underweight	Underweight
MNK 5 5/8 10/15/23	Underweight	Underweight

Source: Barclays Research

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Primary Issuers/Bonds

ENDO DAC / ENDO FINANCE LLC / ENDO FINCO INC, CD/D/J/L
ENDP 5 7/8 10/15/24, Overweight (USD 89.00, 14-Aug-2019)
ENDP 6 02/01/25, Overweight (USD 57.75, 14-Aug-2019)
ENDP 6 07/15/23, Overweight (USD 61.00, 14-Aug-2019)

MALLINCKRODT INTERNATIONAL FINANCE SA / MALLINCKRODT CB LLC, CD/D/E/J/K/L/M/N
MNK 5 1/2 04/15/25, Underweight (USD 49.00, 14-Aug-2019)
MNK 5 5/8 10/15/23, Underweight (USD 53.00, 14-Aug-2019)
MNK 5 3/4 08/01/22, Underweight (USD 61.50, 14-Aug-2019)
MNK 4 7/8 04/15/20, Overweight (USD 85.00, 14-Aug-2019)

MALLINCKRODT INTERNATIONAL FINANCE SA, CD/D/E/J/K/L/M/N
MNK 4 3/4 04/15/23, Underweight (USD 47.50, 14-Aug-2019)

PAR PHARMACEUTICAL INC, A/CD/D/J/L
ENDP 7 1/2 04/01/27, Overweight (USD 90.75, 14-Aug-2019)

TEVA PHARMACEUTICAL FINANCE CO BV, CD/J
TEVA 2.95 12/18/22, Overweight (USD 85.50, 14-Aug-2019)
TEVA 3.65 11/10/2021, Overweight (USD 91.50, 14-Aug-2019)

TEVA PHARMACEUTICAL FINANCE CO LLC, CD/D/E/J/K/L/M/N
TEVA 6.15 02/01/36, Underweight (USD 78.00, 14-Aug-2019)

TEVA PHARMACEUTICAL FINANCE IV BV, CD/D/E/J/K/L/M/N
TEVA 3.65 11/10/2021, Overweight (USD 92.00, 14-Aug-2019)

TEVA PHARMACEUTICAL FINANCE IV LLC, CD/D/E/J/K/L/M/N
TEVA 2 1/4 03/18/20, Market Weight (USD 98.50, 14-Aug-2019)

TEVA PHARMACEUTICAL FINANCE NETHERLANDS II BV, CD/D/E/J/K/L/M/N
TEVA 0 3/8 07/25/20, Market Weight (EUR 97.05, 14-Aug-2019)

TEVA 1 1/4 03/31/23, Underweight (EUR 79.96, 14-Aug-2019)
TEVA 1 1/8 10/15/24, Underweight (EUR 72.88, 14-Aug-2019)
TEVA 1 5/8 10/15/28, Underweight (EUR 64.29, 14-Aug-2019)
TEVA 1 7/8 03/31/27, Underweight (EUR 69.21, 14-Aug-2019)

TEVA PHARMACEUTICAL FINANCE NETHERLANDS III BV, CD/J
TEVA 2.8 07/21/23, Underweight (USD 80.75, 14-Aug-2019)
TEVA 3.15 10/01/26, Underweight (USD 72.00, 14-Aug-2019)
TEVA 4.1 10/01/46, Underweight (USD 64.50, 14-Aug-2019)
TEVA 6 04/15/24, Underweight (USD 85.00, 14-Aug-2019)
TEVA 6 3/4 03/01/28, Underweight (USD 81.50, 14-Aug-2019)
TEVA 2.2 07/21/21, Overweight (USD 91.00, 14-Aug-2019)

TEVA PHARMACEUTICAL FINANCE NETHERLANDS IV BV, CD/J/K/N
TEVA 0 1/2 07/28/22, Market Weight (CHF 86.85, 14-Aug-2019)
TEVA 1 07/28/25, Underweight (CHF 76.09, 14-Aug-2019)

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U: The equity securities of this Canadian issuer include subordinate voting restricted shares.
V: The equity securities of this Canadian issuer include non-voting restricted shares.

Explanation of the Barclays Research Corporate Credit Sector Rating System

Overweight (OW):
For sectors rated against the Bloomberg Barclays U.S. Credit Index, the Bloomberg Barclays Pan-European Credit Index, the Bloomberg Barclays EM Asia USD High Grade Credit Index or the Bloomberg Barclays EM USD Corporate and Quasi-Sovereign Index, the analyst expects the six-month excess return

of the sector to exceed the six-month excess return of the relevant index.
For sectors rated against the Bloomberg Barclays U.S. High Yield 2% Issuer Capped Credit Index, the Bloomberg Barclays Pan-European High Yield 3% Issuer Capped Credit Index excluding Financials, the Bloomberg Barclays Pan-European High Yield Finance Index or the Bloomberg Barclays EM Asia USD High Yield Corporate Credit Index, the analyst expects the six-month total return of the sector to exceed the six-month total return of the relevant index.

Market Weight (MW):
For sectors rated against the Bloomberg Barclays U.S. Credit Index, the Bloomberg Barclays Pan-European Credit Index, the Bloomberg Barclays EM Asia USD High Grade Credit Index or the Bloomberg Barclays EM USD Corporate and Quasi-Sovereign Index, the analyst expects the six-month excess return of the sector to be in line with the six-month excess return of the relevant index.
For sectors rated against the Bloomberg Barclays U.S. High Yield 2% Issuer Capped Credit Index, the Bloomberg Barclays Pan-European High Yield 3% Issuer Capped Credit Index excluding Financials, the Bloomberg Barclays Pan-European High Yield Finance Index or the Bloomberg Barclays EM Asia USD High Yield Corporate Credit Index, the analyst expects the six-month total return of the sector to be in line with the six-month total return of the relevant index.

Underweight (UW):
For sectors rated against the Bloomberg Barclays U.S. Credit Index, the Bloomberg Barclays Pan-European Credit Index, the Bloomberg Barclays EM Asia USD High Grade Credit Index or the Bloomberg Barclays EM USD Corporate and Quasi-Sovereign Index, the analyst expects the six-month excess return of the sector to be less than the six-month excess return of the relevant index.
For sectors rated against the Bloomberg Barclays U.S. High Yield 2% Issuer Capped Credit Index, the Bloomberg Barclays Pan-European High Yield 3% Issuer Capped Credit Index excluding Financials, the Bloomberg Barclays Pan-European High Yield Finance Index or the Bloomberg Barclays EM Asia USD High Yield Corporate Credit Index, the analyst expects the six-month total return of the sector to be less than the six-month total return of the relevant index.

Sector definitions:
Sectors in U.S. High Grade Research are defined using the sector definitions of the Bloomberg Barclays U.S. Credit Index and are rated against the Bloomberg Barclays U.S. Credit Index.
Sectors in U.S. High Yield Research are defined using the sector definitions of the Bloomberg Barclays U.S. High Yield 2% Issuer Capped Credit Index and are rated against the Bloomberg Barclays U.S. High Yield 2% Issuer Capped Credit Index.

Sectors in European High Grade Research are defined using the sector definitions of the Bloomberg Barclays Pan-European Credit Index and are rated against the Bloomberg Barclays Pan-European Credit Index.
Sectors in Industrials and Utilities in European High Yield Research are defined using the sector definitions of the Bloomberg Barclays Pan-European High Yield 3% Issuer Capped Credit Index excluding Financials and are rated against the Bloomberg Barclays Pan-European High Yield 3% Issuer Capped Credit Index excluding Financials.
Sectors in Financials in European High Yield Research are defined using the sector definitions of the Bloomberg Barclays Pan-European High Yield Finance Index and are rated against the Bloomberg Barclays Pan-European High Yield Finance Index.

Sectors in Asia High Grade Research are defined on Barclays Live and are rated against the Bloomberg Barclays EM Asia USD High Grade Credit Index.
Sectors in Asia High Yield Research are defined on Barclays Live and are rated against the Bloomberg Barclays EM Asia USD High Yield Corporate Credit Index.

Sectors in EEMEA and Latin America Research are defined on Barclays Live and are rated against the Bloomberg Barclays EM USD Corporate and Quasi Sovereign Index. These sectors may contain both High Grade and High Yield issuers.

To view sector definitions and monthly sector returns for Asia, EEMEA and Latin America Research, go to https://live.barcap.com/go/research/EMSectorReturns on Barclays Live.

Explanation of the Barclays Research Corporate Credit Rating System

For all High Grade issuers covered in the US, Europe or Asia, and for all issuers in Latin America and EEMEA, the credit rating system is based on the analyst's view of the expected excess return over a six-month period of the issuer's index-eligible corporate debt securities* relative to the expected excess return of the relevant sector, as specified on the report.

Overweight (OW): The analyst expects the six-month excess return of the issuer's index-eligible corporate debt securities to exceed the six-month expected excess return of the relevant sector.
Market Weight (MW): The analyst expects the six-month excess return of the issuer's index-eligible corporate debt securities to be in line with the six-month expected excess return of the relevant sector.
Underweight (UW): The analyst expects the six-month excess return of the issuer's index-eligible corporate debt securities to be less than the six-month expected excess return of the relevant sector.
Rating Suspended (RS): The rating has been suspended temporarily due to market events that make coverage impracticable or to comply with applicable regulations and/or firm policies in certain circumstances including where the Investment Bank of Barclays Bank PLC is acting in an advisory capacity in a merger or strategic transaction involving the company.
Coverage Suspended (CS): Coverage of this issuer has been temporarily suspended.
Not Covered (NC): Barclays' fundamental credit research team does not provide formal, continuous coverage of this issuer and has not assigned a rating to the issuer or its debt securities. Any analysis, opinion or trade recommendation provided on a Not Covered issuer or its debt securities is valid only as of

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For all High Yield issuers (excluding those covered in EEMEA or Latin America), the credit rating system is based on the analyst's view of the expected total returns over a six-month period of the rated debt security relative to the expected total return of the relevant sector, as specified on the report.

Overweight (OW): The analyst expects the six-month total return of the debt security subject to this rating to exceed the six-month expected total return of the relevant sector.
Market Weight (MW): The analyst expects the six-month total return of the debt security subject to this rating to be in line with the six-month expected total return of the relevant sector.
Underweight (UW): The analyst expects the six-month total return of the rated debt security subject to this rating to be less than the six-month expected total return of the relevant sector.
Rating Suspended (RS): The rating has been suspended temporarily due to market events that make coverage impracticable or to comply with applicable regulations and/or firm policies in certain circumstances including where the Investment Bank of Barclays Bank PLC is acting in an advisory capacity in a merger or strategic transaction involving the company.
Coverage Suspended (CS): Coverage of this issuer has been temporarily suspended.
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Where a recommendation is made at the issuer level, it does not apply to any sanctioned securities, where trading in such securities would be prohibited under applicable law, including sanctions laws and regulations.

*In EEMEA and Latin America (and in certain other limited instances in other regions), analysts may occasionally rate issuers that are not part of the Bloomberg Barclays U.S. Credit Index, the Bloomberg Barclays Pan-European Credit Index, the Bloomberg Barclays EM Asia USD High Grade Credit Index or Bloomberg Barclays EM USD Corporate and Quasi Sovereign Index. In such cases the rating will reflect the analyst's view of the expected excess return over a six-month period of the issuer's corporate debt securities relative to the expected excess return of the relevant sector, as specified on the report.

Distribution of ratings assigned by Barclays Corporate Credit Research at the bond level:
20% have been assigned an Overweight rating which, for purposes of mandatory regulatory disclosures, is classified as a Buy rating; 57% of bonds with this rating category are investment banking clients of the Firm; 71% of the issuers with this rating have received financial services from the Firm.
55% have been assigned Market Weight rating which, for purposes of mandatory regulatory disclosures, is classified as a Hold rating; 57% of bonds with this rating category are investment banking clients of the Firm; 76% of the issuers with this rating have received financial services from the Firm.
25% have been assigned an Underweight rating which, for purposes of mandatory regulatory disclosures, is classified as a Sell rating; 45% of bonds with this rating category are investment banking clients of the Firm; 68% of the issuers with this rating have received financial services from the Firm.

Explanation of the Barclays EM Sovereign Credit Issuer Rating System
Overweight (OW):
The analyst expects the six-month excess return of the country's index eligible bonds to exceed the six-month excess return of the Bloomberg Barclays EM USD Sovereign Index.
Market Weight (MW):
The analyst expects the six-month excess return of the country's index eligible bonds to be in line with the six-month excess return of the Bloomberg Barclays EM USD Sovereign Index.
Underweight (UW):
The analyst expects the six-month excess return of the country's index eligible bonds to be less than the six-month excess return of the Bloomberg Barclays EM USD Sovereign Index.
Rating Suspended (RS):
The rating has been suspended temporarily due to market events that make coverage impracticable or to comply with applicable regulations and/or firm policies in certain circumstances including where the Investment Bank of Barclays Bank PLC is acting in an advisory capacity.

Distribution of ratings assigned by Barclays Emerging Markets Sovereign Research at the issuer level:
29% have been assigned an Overweight rating which, for purposes of mandatory regulatory disclosures, is classified as a Buy rating; 20% of issuers with this rating category are investment banking clients of the Firm; 70% of the issuers with this rating have received financial services from the Firm.
44% have been assigned Market Weight rating which, for purposes of mandatory regulatory disclosures, is classified as a Hold rating; 13% of issuers with this rating category are investment banking clients of the Firm; 67% of the issuers with this rating have received financial services from the Firm.
26% have been assigned an Underweight rating which, for purposes of mandatory regulatory disclosures, is classified as a Sell rating; 44% of issuers with this rating category are investment banking clients of the Firm; 89% of the issuers with this rating have received financial services from the Firm.

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