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Cocaine Control: Supply and Demand Programs

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PREFACE

This Draft documents a briefing given to the Office of National Drug Control Policy in December 1992. It reports on work in progress comparing the cost effectiveness of alternative drug control programs. Both supply-control and demand-control programs are evaluated. The briefing focuses on cocaine control, but the methods are applicable to other drugs as well.

Support for this research was provided by the Office of National Drug Control Policy and by RAND's Drug Policy Research Center with funding from the Ford Foundation.

SUMMARY

In recent years Federal government's emphasis on source country control of drugs, and Local government's emphasis on law enforcement has been increasingly criticized by advocates of programs that treat drug users. This briefing reports on preliminary results of research aimed at comparing the cost effectiveness of the supply-control programs currently in fashion with the demand-control programs that appear to be gaining increased support.

The research reported here focuses on cocaine. The analysis evaluates supply-control programs inside the United States as well as in source countries, and it evaluates treatment programs for light users as well as for heavy users of cocaine. The analysis does not consider prevention programs aimed at reducing the incidence of new users, nor does it consider the effect of criminal justice sanctions on users.

The measure of merit used to compare the different programs is the public cost of decreasing United States consumption of cocaine by specific amounts. Using a computer model, each control program is independently increased by an amount sufficient to cause a one percent decrease in consumption. Then the programs are ranked by the cost of the required program increase. The ranking from most expensive to least expensive (per comparable reduction in consumption) is: source country control, interdiction, domestic control, treatment of light users, treatment of heavy users.

Using this information on marginal cost effectiveness of the alternative programs the analysis constructs a set of alternative composite plans to illustrate the spectrum of possibilities. These plans range from costing approximately two billion dollars less to two billion dollars more than the current eight billion dollars a year spent on cocaine control by all levels of government, and the plans range from having about 10 metric tons more to 40 metric tons less than the current 180 metric tons a year cocaine consumed in the United States.

ACKNOWLEDGMENTS

The support of RAND colleagues Steve Bankes, Audrey Burnam, Pat Ebener, Phyllis Ellickson, Susan Everingham, Jim Gillogly, Dan McCaffrey, Peter Reuter, and Jack Riley, helping construct this briefing, sharing work in progress, and making numerous useful suggestions, is gratefully acknowledged.

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COMPOSITE STRATEGIES

COCAINE CONTROL:
SUPPLY AND DEMAND PROGRAMS
Work in Progress

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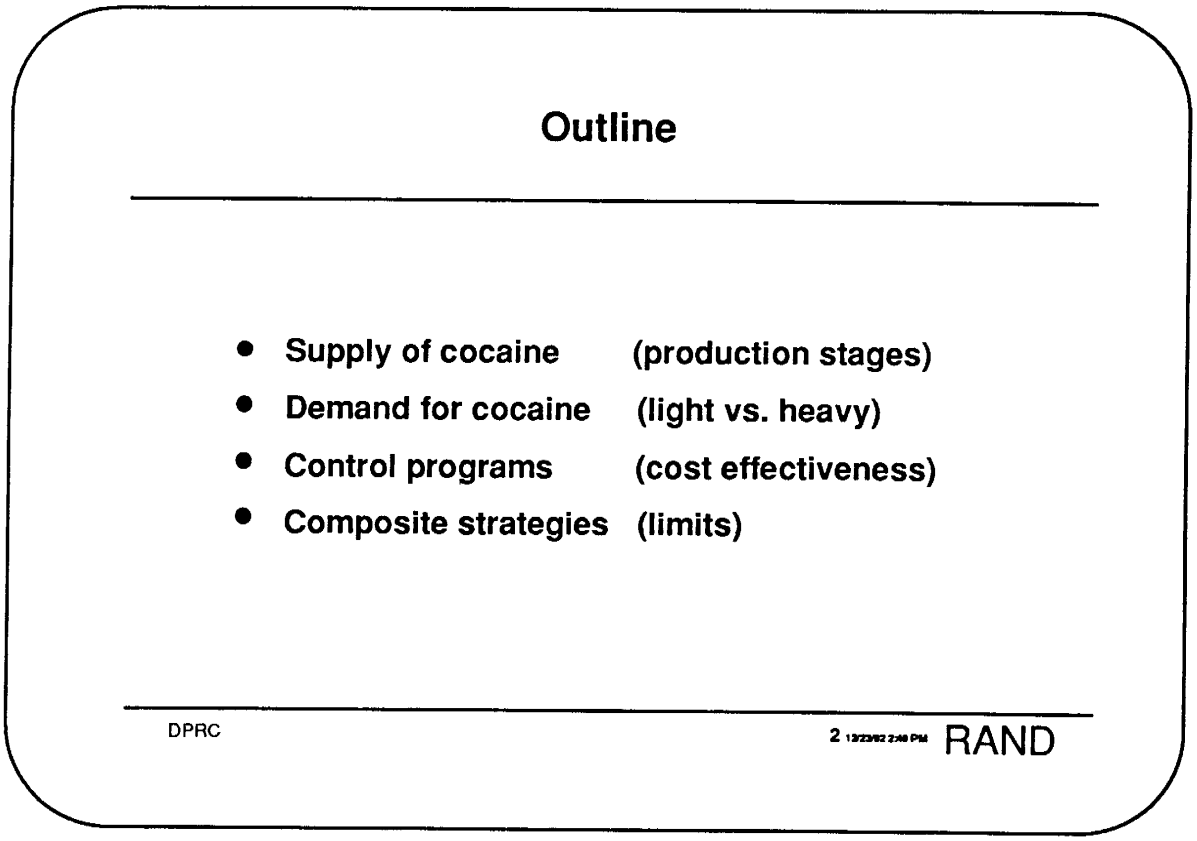
This briefing reports progress to date. Model specification and parameter estimates are currently being refined. The preliminary results presented here are intended as guides to the ongoing research, rather than as the final product of that research.



This presentation covers highlights of current results on cocaine supply, cocaine demand, alternative control programs, and how those programs can be combined into composite strategies.

Concepts to focus on during the discussion are:

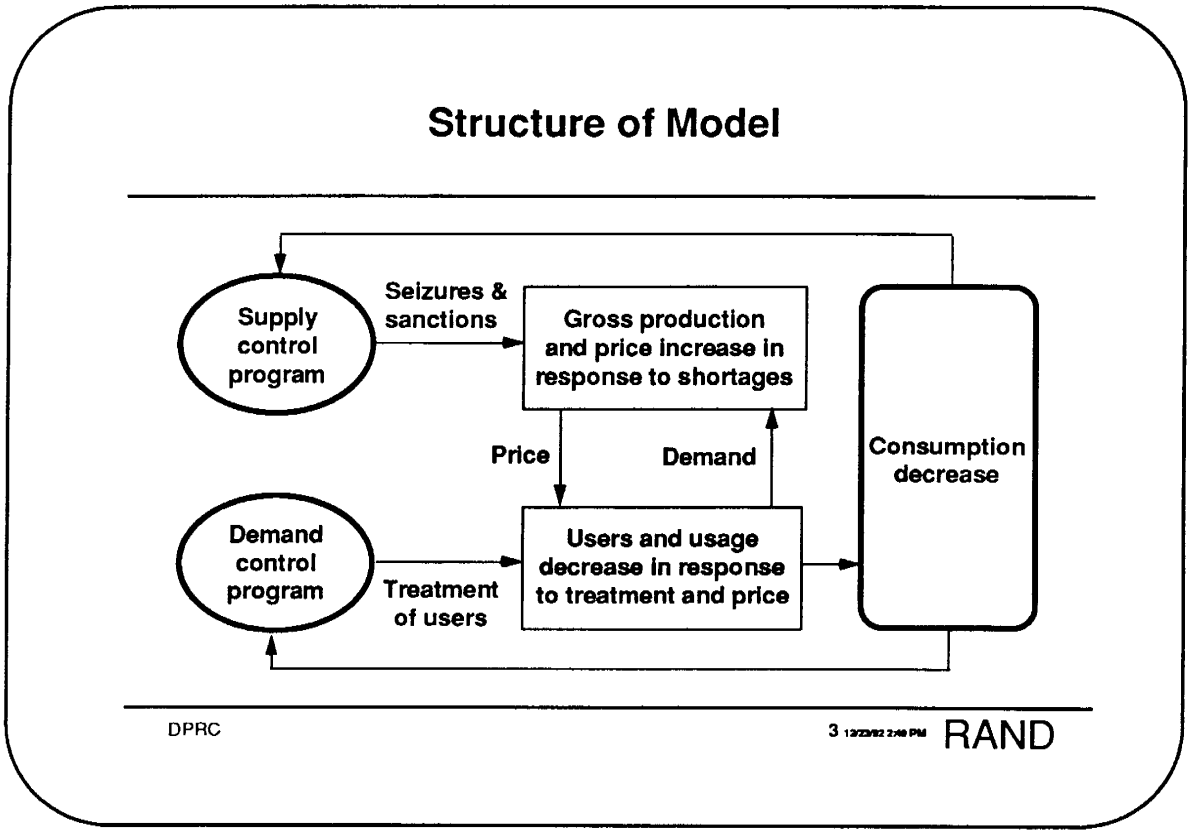
(a) the production stage where supply control works best,

(b) the effect of light vs. heavy use on consumption trends,

(c) evaluating programs not in terms of intermediate effects such as metric tons seized or persons treated, but rather with the "bottom line" measures of control cost and reduction in cocaine consumption, and

(d) having found out the direction in which to go, there are limits to how far one can go.

The supply and demand sections are introduced by a summary of the way control programs work in each area.

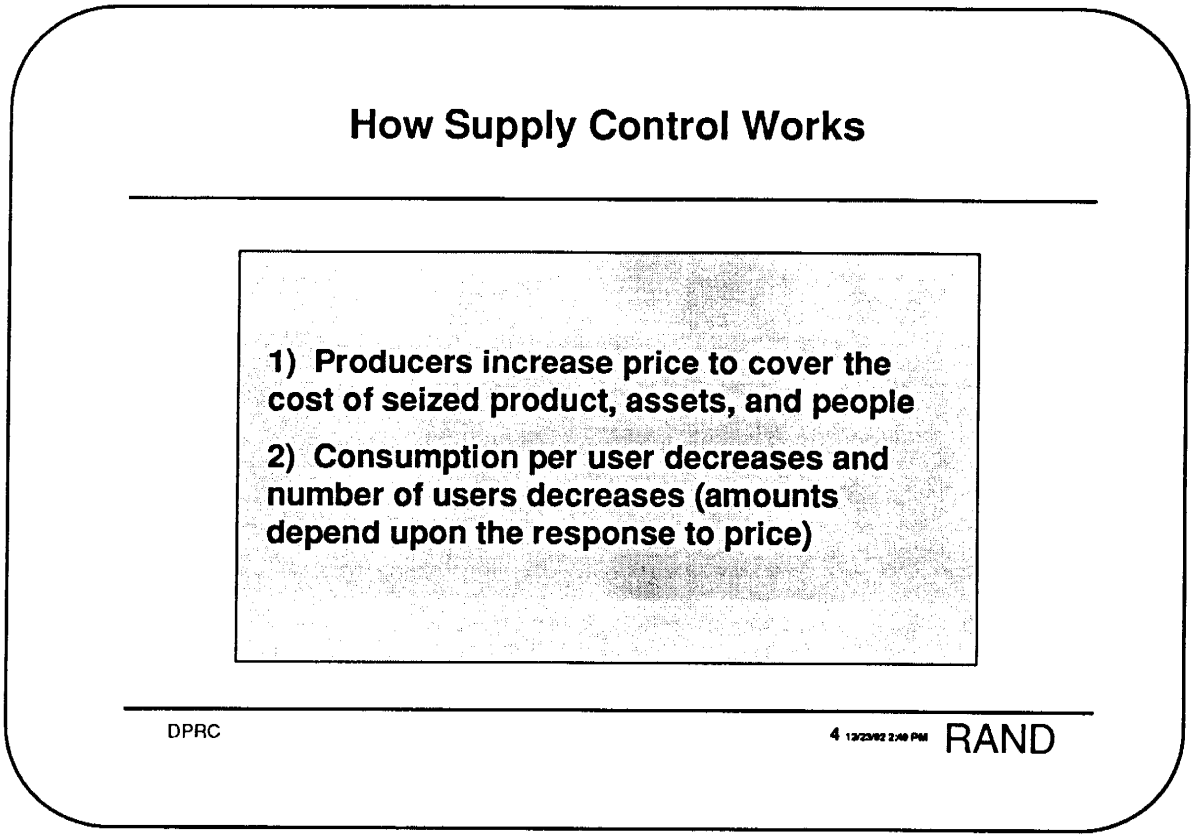


The computer model used to evaluate the cost effectiveness of drug control programs in this analysis has two levels.

The model's first level balances market supply and demand. Producers react to seizures and sanctions by increasing price and gross production. Consumers react to treatment and to price increases by consuming less. This part of the model iterates until supply and demand are in equilibrium in each of 15 projection years.

The model's second level assesses the consumption decrease caused by given changes in supply and/or demand control programs.

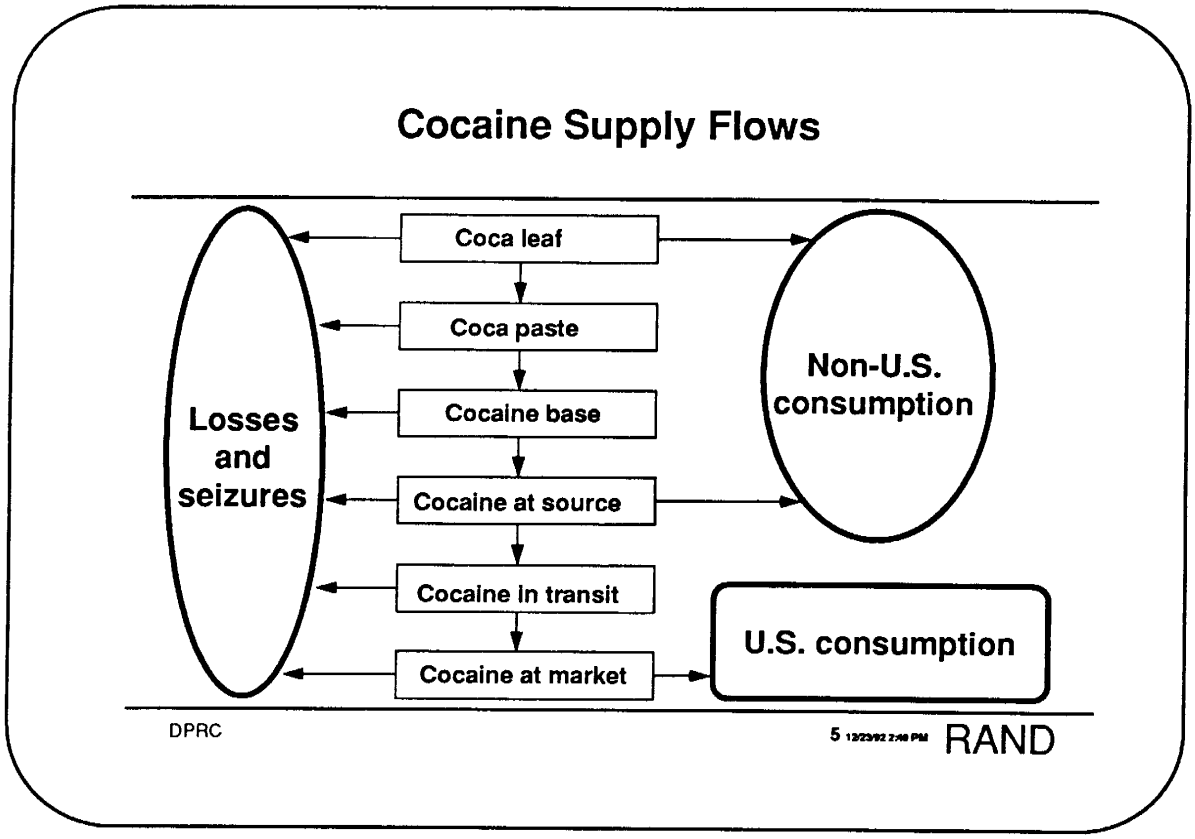
Outcomes are evaluated over 15 projection years, using a 4% annual real discount rate.



The loss of product seized regularly and predictably is anticipated by producers, and they increase production to allow for the losses. A price increase on the surviving product is necessary to cover the cost of the increased production, because the seized product generates no revenue. Price increases also result from asset seizures and criminal justice sanctions on drug dealers.

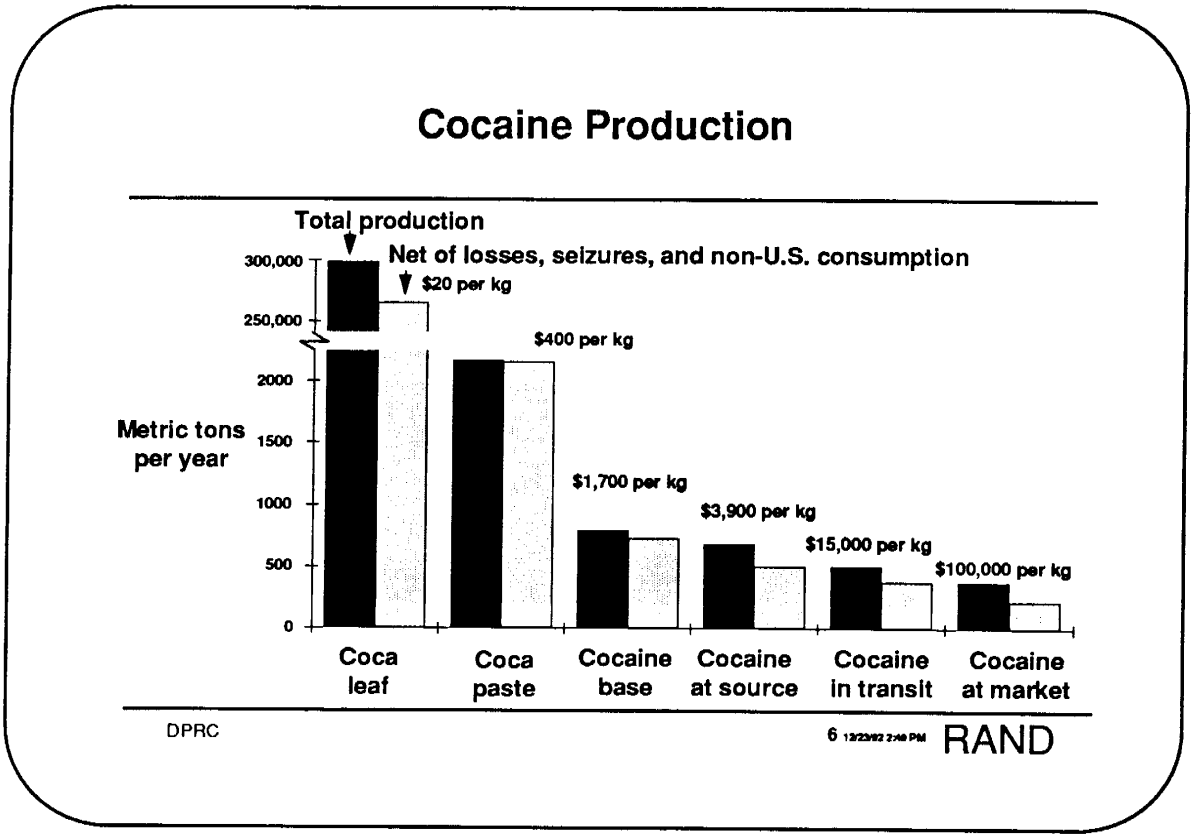
The price elasticity of demand then links these seizures and sanctions to consumption reductions. It determines how much consumption will decrease when price rises.

Not surprisingly, given that cocaine is an illegal product, next to no research has been done to estimate how demand for it responds to price changes. However, we can look at empirical evidence on the price elasticities of other products such as cigarettes and alcohol and make reasonable assumptions about how cocaine consumption responds to price.



This diagram summarizes the cocaine supply pipeline. There are many steps in the production, transportation, and distribution process. At each step there are losses and seizures, and at some of the steps there is consumption of that step's product.

In this analysis we are interested in the amount that reaches the United States, but to understand that we need to model the entire production pipeline.

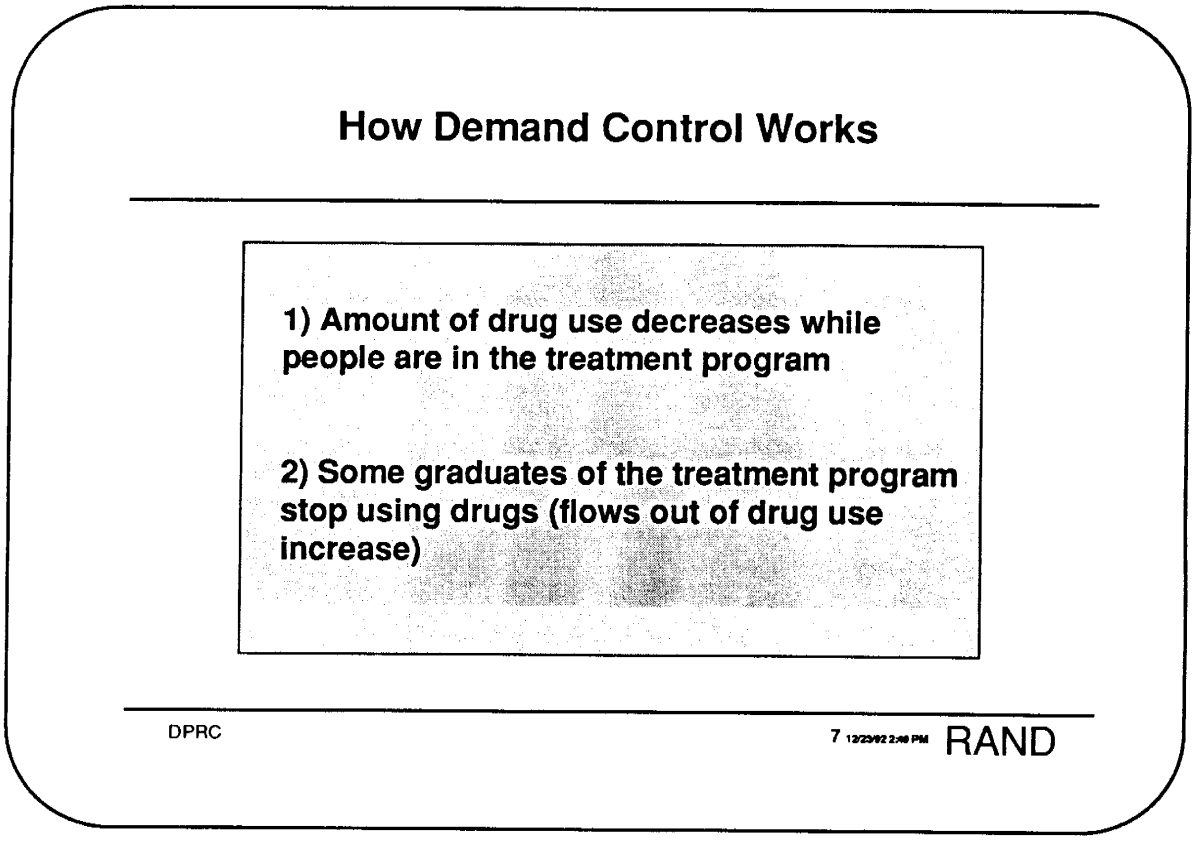


Cocaine production is a weight losing process, and a value gaining process. Both characteristics are dramatic (note the break in scale to fit both ends of the pipeline on a single graph).

The weight decrease from net production at one stage to total production in the next stage is the result of production yields that are less than a metric ton of output per metric ton of input.

The weight decrease from total to net production, at each stage, is caused by non U.S. consumption and product losses and seizures.

The increase in prices along the pipeline make seizing product at the later stages more attractive than seizing it an early stage, because the replacement cost is much larger at the later stages.



Demand programs affect drug consumption directly by changing the number of users and/or the usage rate per person, rather than indirectly through price increases as supply programs do. However, nothing is simple. Just counting the number of people passing through drug treatment programs is not enough to decide whether they are worth their cost. The effects on drug consumption, both immediately and over the longer term, must be estimated. Moreover, "self-cures" -- changes in drug consumption that would have occurred in the absence of treatment -- must be controlled for to arrive at the program effect.

Definition of Light and Heavy Cocaine Users

Frequency of Use	Classification
1-2 days per year	Light
3-5 days per year	Light
Every other month or so	Light
1-2 times a month	Light
Several times a month	**Heavy**
1-2 days a week	**Heavy**
3-6 days a week	**Heavy**
Every day	**Heavy**

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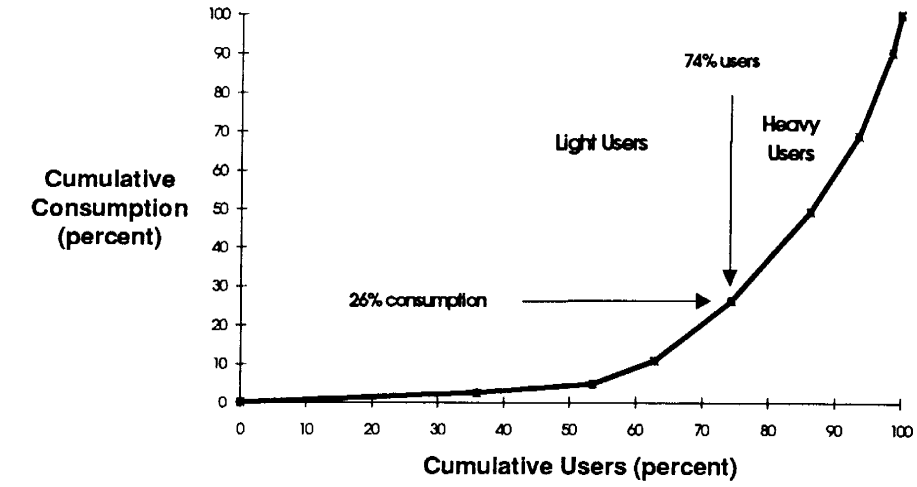
"Light" vs. "heavy" use is defined in this analysis by frequency of use. Several times a month or more is classified as "heavy."

Most Consumption Is By Heavy Users



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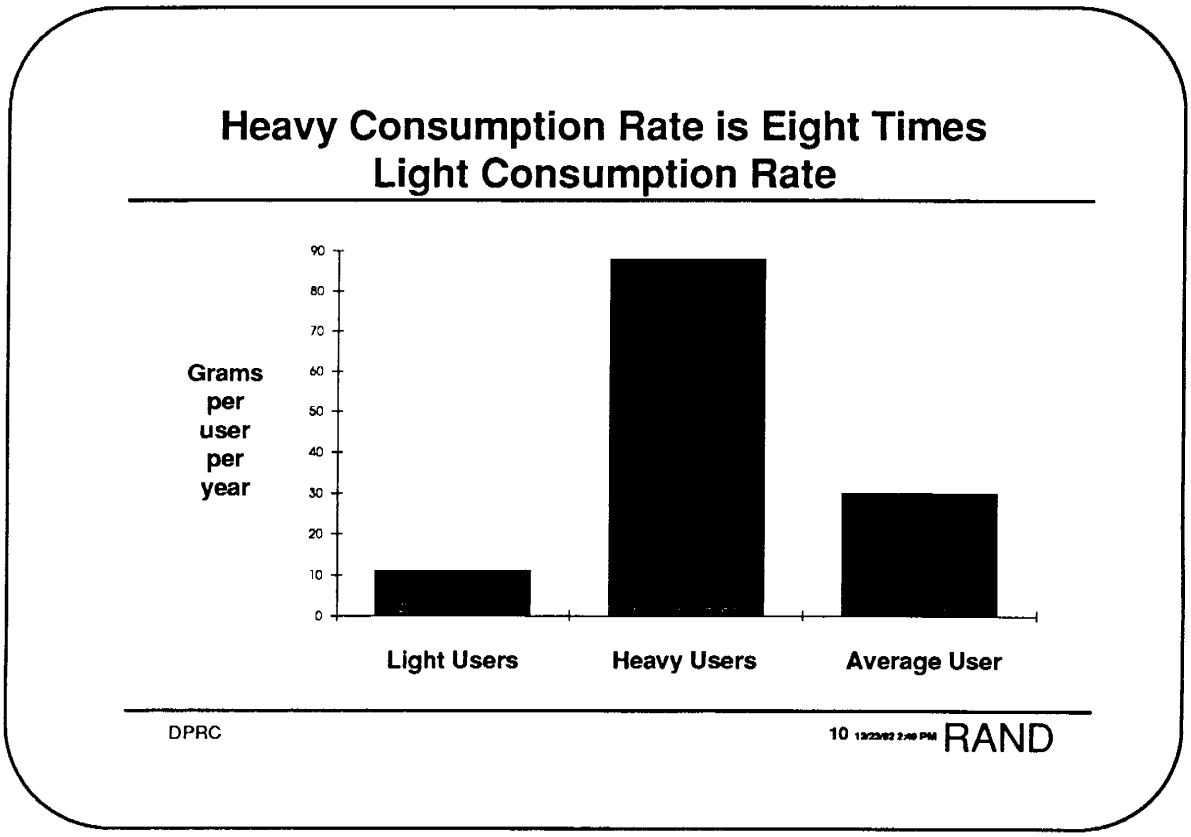
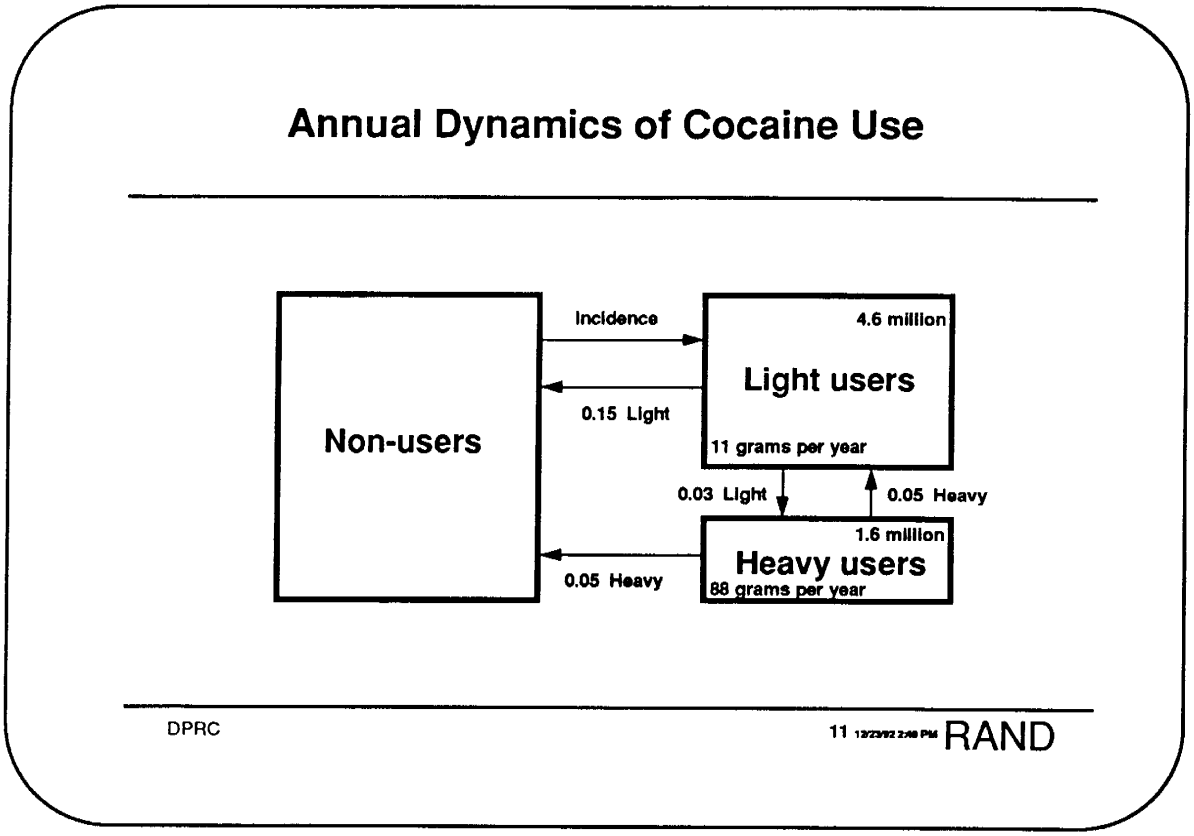
This curve was estimated from the 1990 household survey data. The household survey does not reach people who are not in households: criminals, mentally ill, and homeless. The omitted users are believed to be mostly heavy users. So, the actual cumulative consumption curve is bowed downward even more than shown here.

Heavy users are the top fourth of users, and they account for three-fourths of the total annual U.S. consumption of cocaine.



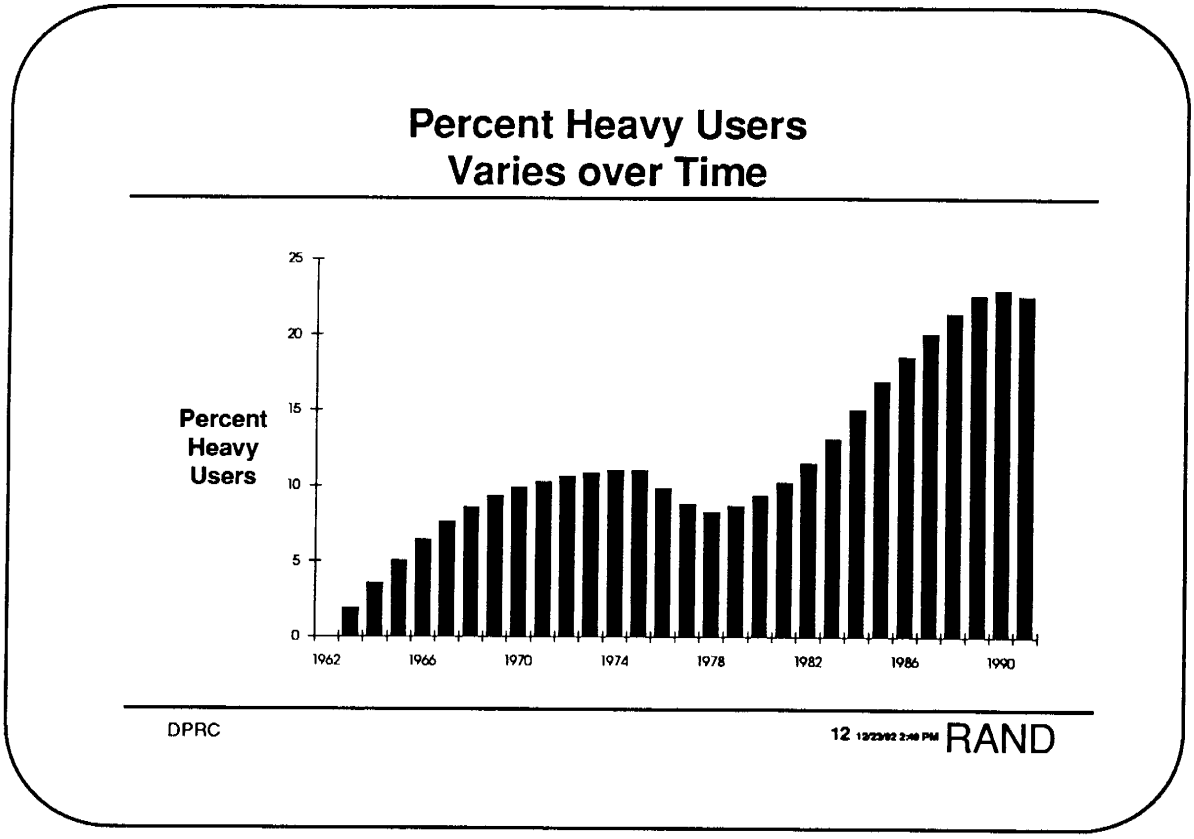
Heavy users being 1/4 of all users consuming 3/4 of the cocaine, and light users being 3/4 of all users consuming 1/4 of the cocaine, means that heavy users are consuming cocaine at a rate that is eight times that of light users.



Fitting a flow model to historical data yields the above estimates of demand behavior. The fit to historical data is good, but is not reported here.

This model, with the estimated flow rates, is adequate to evaluate the relative accomplishments of alternative control strategies. However, the model must not be taken too literally. For example, heavy users of cocaine who quit each year may well go through a complicated pattern of stopping and starting at many levels of use, none of which is captured by an annual-time-step model that recognizes only two levels of use.

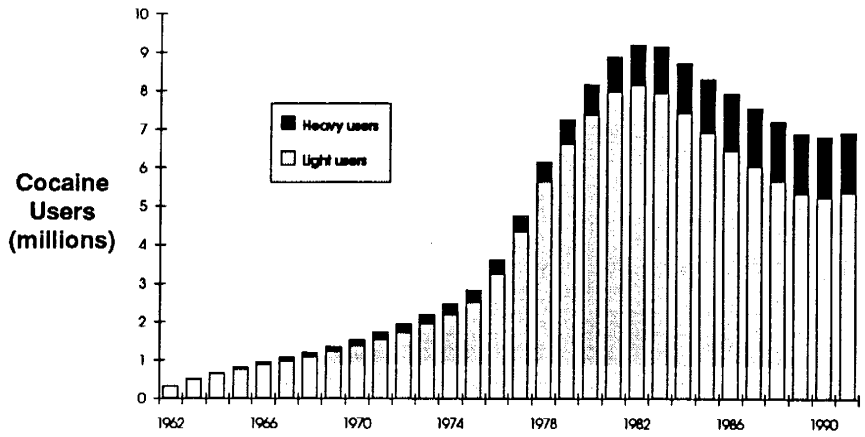
Incidence (the flow of new users into the light user group) varies over time and is a scripted input to this demand model. Then the outflows from light and heavy use are modeled as constant rates. The specific estimates are that each year 15% of light users quit using cocaine while 3% move to heavy use, and that each year 5% of heavy users quit using cocaine while another 5% go back to light use.



The demand model just presented generates descriptions of the current cocaine epidemic that can be thought of as interpolations and extrapolations of available historical data.

The decline in percent heavy users in the late 70s was due to increased inflow of new light users. The increase in percent heavy users in the late 80s was due to a decrease in incidence combined with a flow of some of the large build up in light users into heavy use.

Prevalence of Light and Heavy Users



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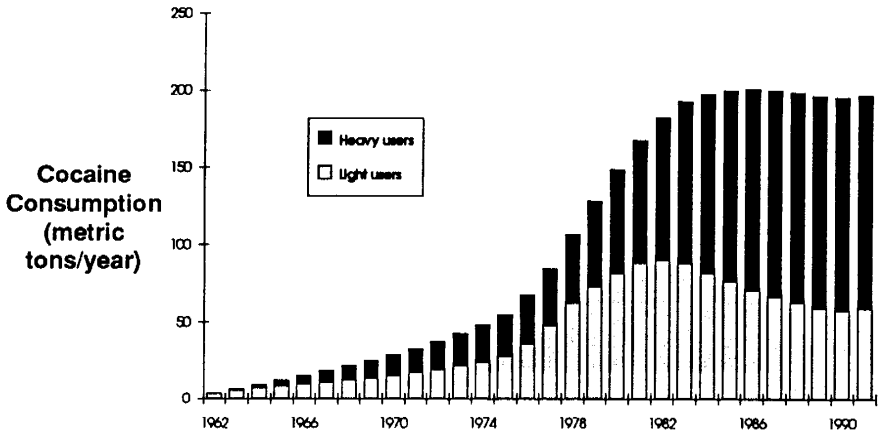
The number of light users declined in the late 80s, but the number of heavy users remains large.

Consumption by Light and Heavy Users



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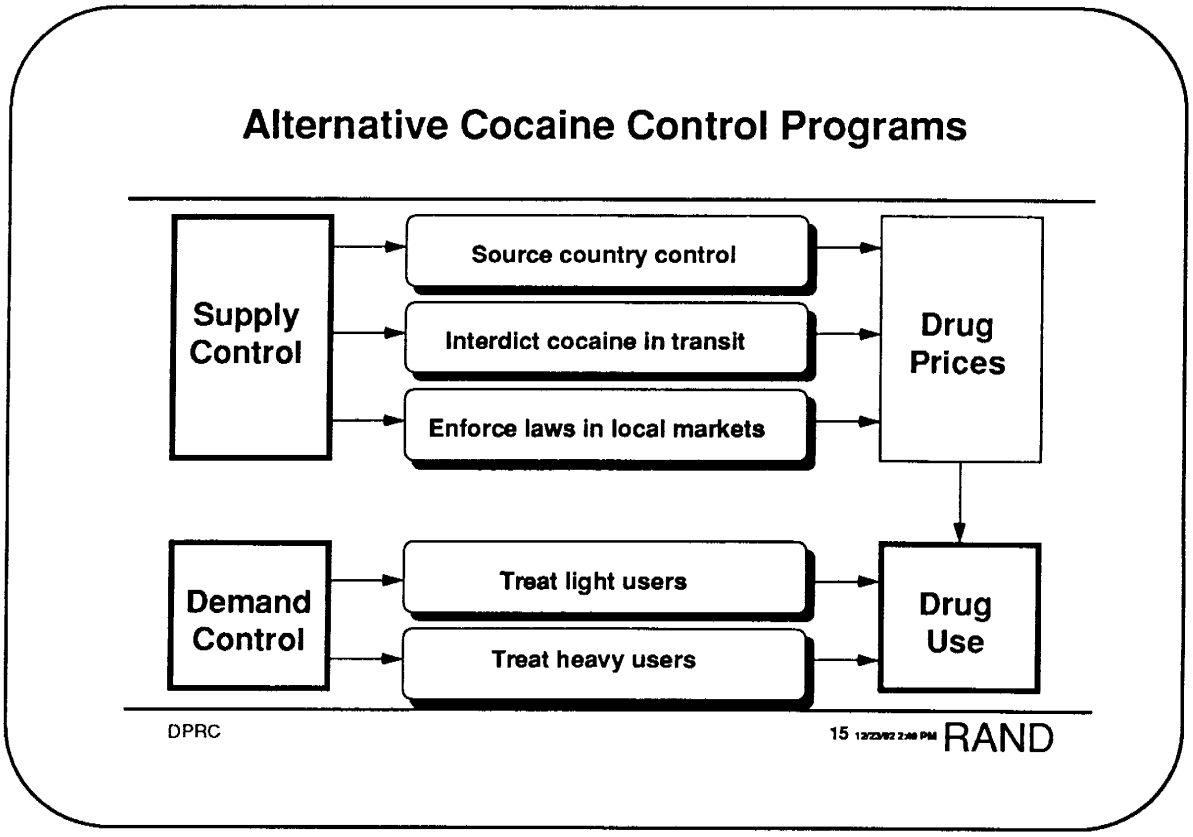
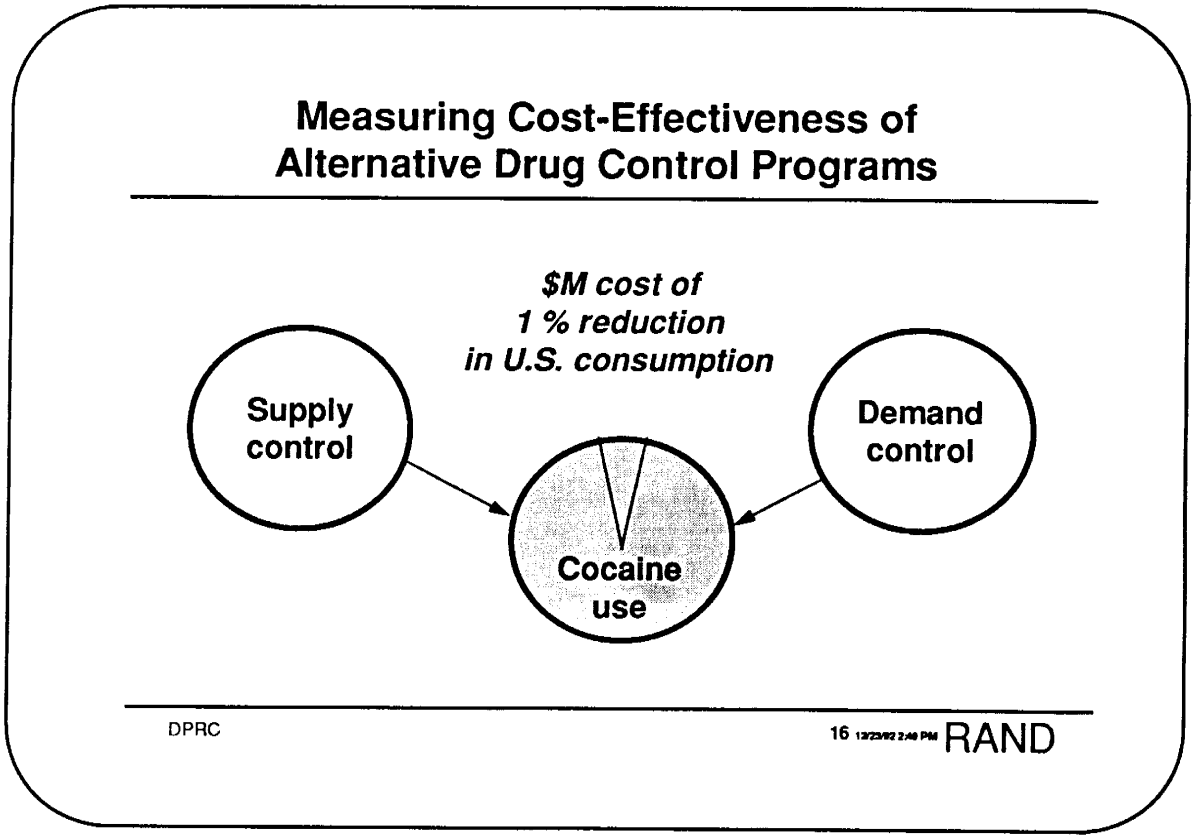
Because the number of heavy users remains high, total consumption remains high. This persistence of total consumption is in marked contrast with the recent decline in prevalence shown on the previous slide.



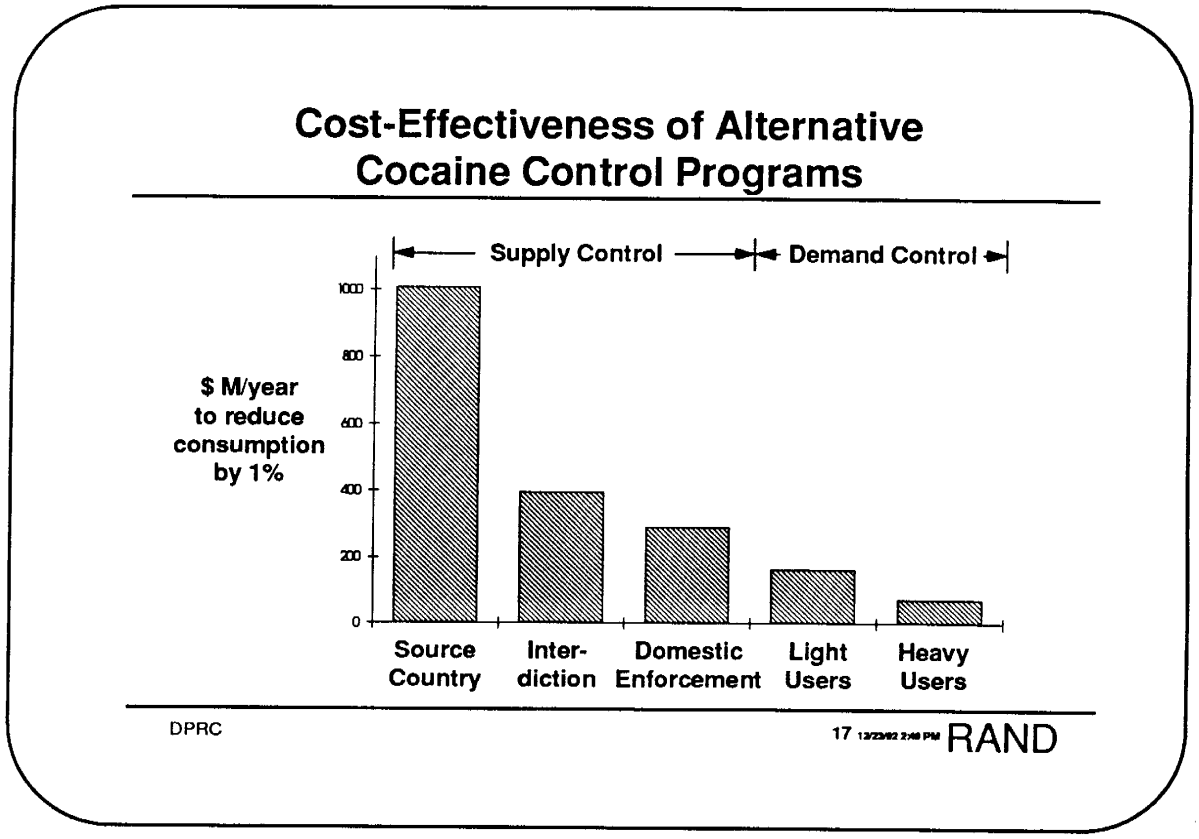
This analysis reports results on three types of supply control: source country control (including control at all stages of production in source countries), interdiction in transit (including asset seizures as well as product seizures), and domestic enforcement (including criminal justice sanctions on drug dealers as well as product seizures).

The analysis of demand control considers treatment of light users as well as treatment of heavy users. However, the analysis of demand control does not include prevention programs (education about drugs and how to avoid using drugs), nor does it include deterrence programs (criminal justice and/or social sanctions on drug use).



Supply-control and demand-control programs are fundamentally different. Supply-control programs affect consumption indirectly through price increases; demand-control programs affect consumption directly through reducing the number of users. However, both types of programs share the characteristic that their immediate program outcomes -- product seizures and persons treated -- are not, by themselves, sufficient to evaluate program performance. The links between these immediate outputs and final outcomes must be forged before program comparisons are possible.

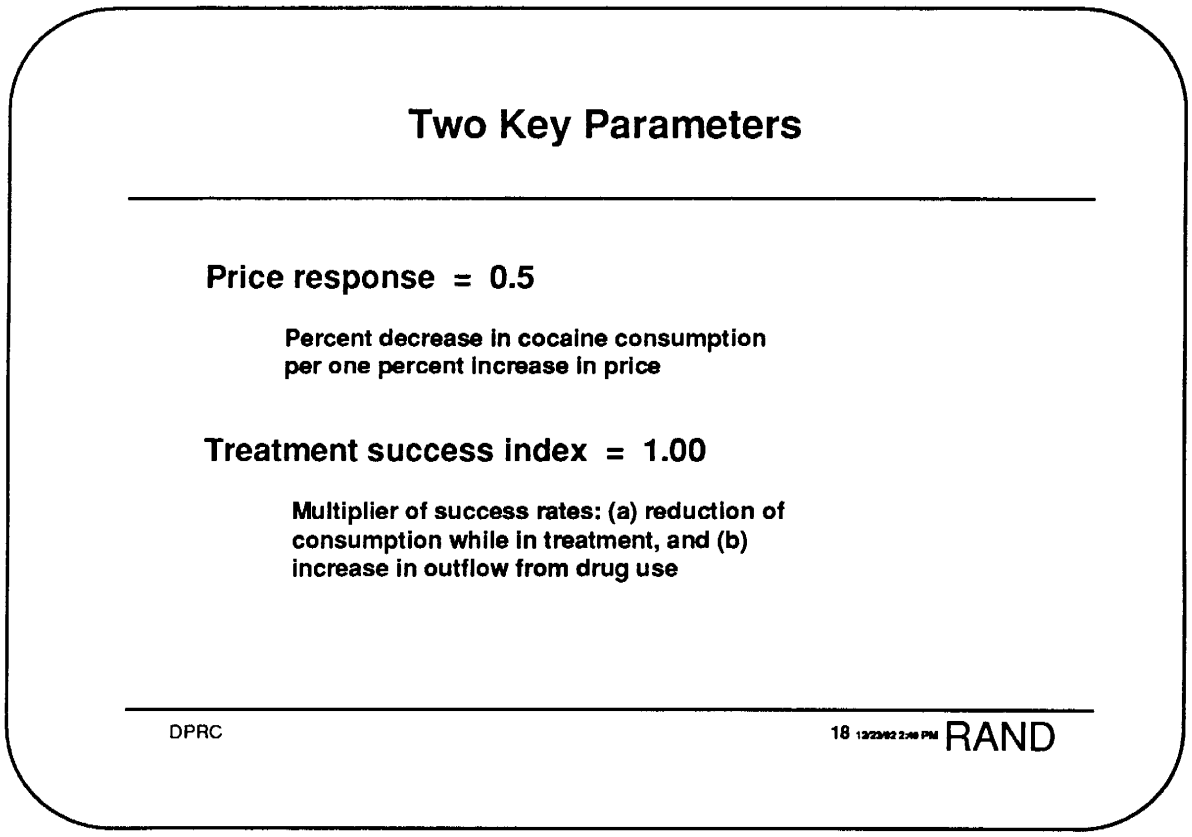
In the present study, the common outcome used to evaluate both supply- and demand-control programs is the annual cost required to reduce United States consumption of cocaine by one percent. In other words, taking one control program at a time, we analytically expand it just enough so that it causes U.S. cocaine consumption to decrease by one percent, then we evaluate the program by how much that expansion cost (see the next slide).



The later along the supply pipeline that one intervenes, the more cost effective the intervention. Higher replacement costs at the later stages cause higher price increases, which in turn cause greater reductions in consumption.

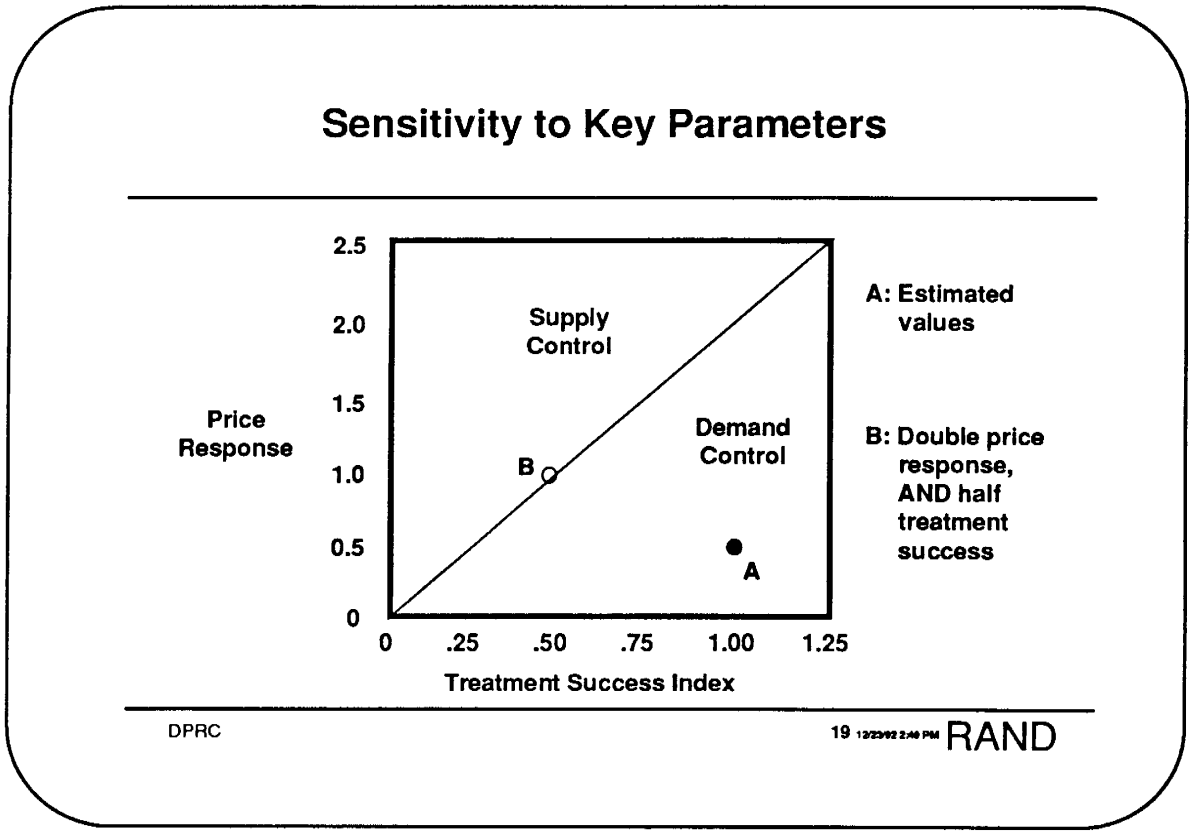
On the demand side, the finding is that treating heavy users is more cost effective than treating light users, but that either treatment is more cost effective than the supply-control programs.

These results are for marginal changes in control programs about current program levels. They do not necessarily indicate marginal cost effectiveness (or even relative cost effectiveness) under greatly different program levels.

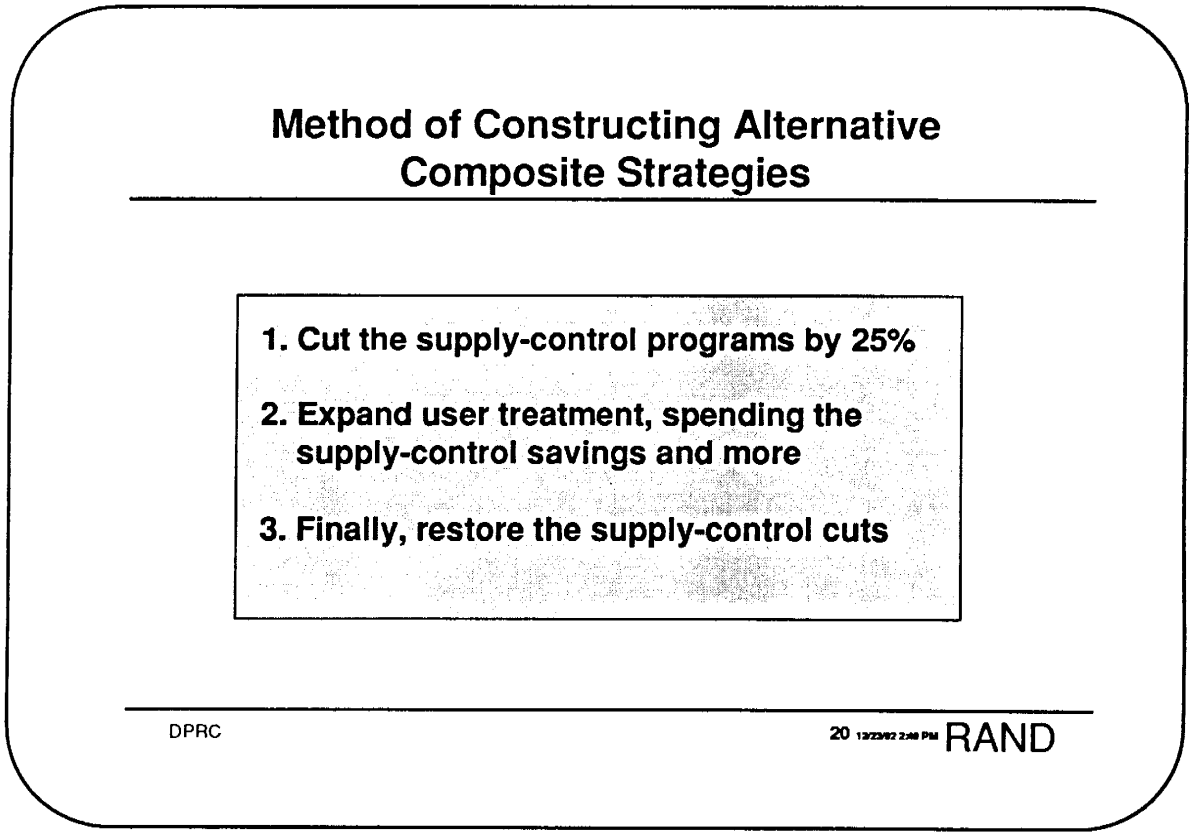


This analysis uses 0.5 for the price elasticity of demand, and it uses several treatment success rates (reductions in consumption while in treatment for both light an heavy user treatments, and increases in outflow from drug use of people who have received light an heavy user treatments).

Sensitivity analysis of the price elasticity are done by varying the 0.5 estimate. Sensitivity analysis of the treatment success rates are done by multiplying all of them by a treatment success index. An index value of 1.00 means that the reference case estimates of the various success rates are used, and an index value of 0.50 means that one-half the reference case estimates of success rates are used.



The estimates of price elasticity and treatment success used in this analysis place the outcome firmly in the region where demand-control is most cost effective. To get to the border where supply control begins to be more cost effective than demand control requires doubling the price responsiveness of demand, and also halving the treatment success rates.



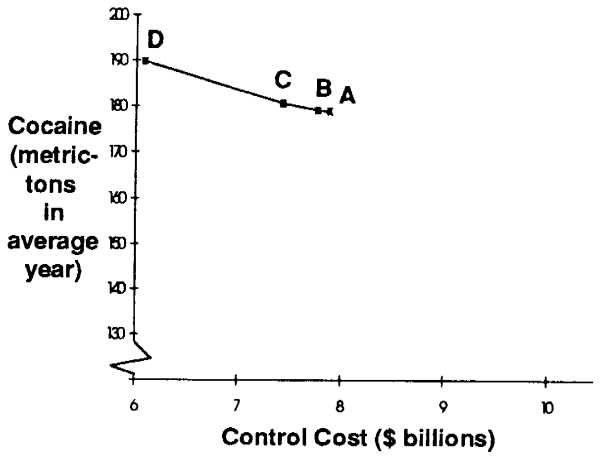
A three-step process constructs a range of composite plans that illustrate possible alternatives to current cocaine-control policy. The general idea is to cut back programs starting with the least cost effective, and then add programs starting with the most cost effective.

In the initial step all supply-control program annual budgets are cut by one-fourth, source-country control first, interdiction second, and domestic enforcement third.

The next step expands user-treatment programs; heavy-user treatment first, then light-user treatment.

Finally, the supply-control budgets are restored, domestic enforcement first, interdiction second, and source country control last.

Cutting Supply Control Saves Money But Increases Cocaine Consumption



A: Basecase

Cut supply control

B: Source country

C: Interdiction

D: Domestic enforcement

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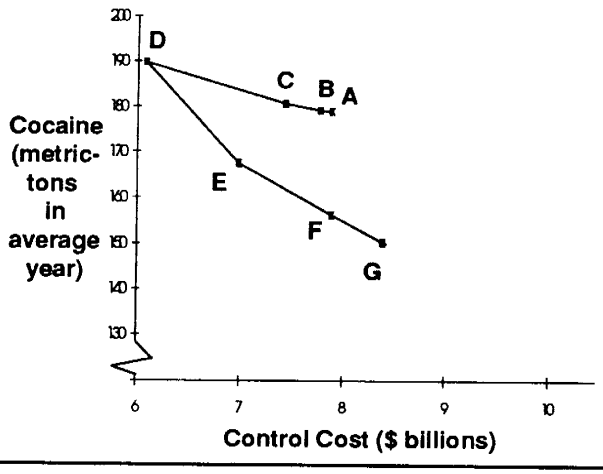
This is the first in a series of four charts that have the same horizontal and vertical scales. The horizontal axis gives total annual cost of cocaine control programs averaged over a 15 year projection period (ranging from 6 to 10 billion). The vertical axis gives average annual U.S. consumption of cocaine, again averaged over a 15 year projection period (ranging from 130 to 200 metric tons).

This slide shows that cutting the supply-control budget by 25% saves almost 2 billion dollars a year, but causes annual cocaine consumption to increase by about 10 metric tons.

Spending Savings on Treatment Results in a Net Decrease in Cocaine Consumption



A: Basecase

Cut supply control

B: Source country

C: Interdiction

D: Domestic enforcement

Increase treatment

E: Heavy users

F: More heavy users

G: Light users

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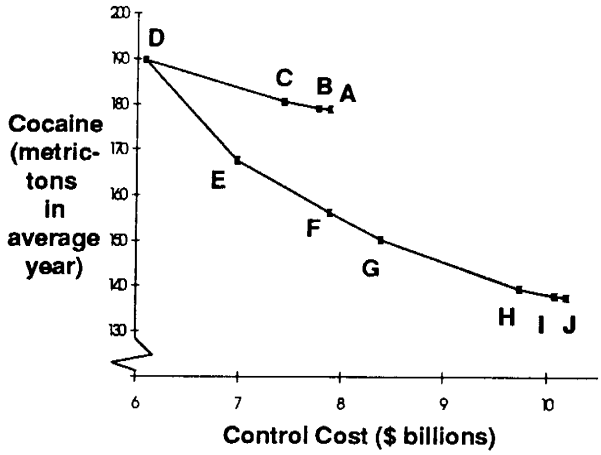
Spending half the savings from the supply-control decrease on treatment of heavy users results in point E in the graph, and spending all the savings results in point F.

The slope of the line connecting two points indicates the cost effectiveness of moving from one plan to the next-- a steeper slope means more cocaine reduction per additional control dollar. Notice difference in the slope of the line connecting points D and E and the line connecting points E and F. This change in slope reflects the diminishing returns caused by increasing need for residential as opposed to outpatient treatment as a large percentage of heavy users are treated.

At point F approximately two-thirds of heavy users are being treated each year. At point G approximately one-fifth of light users are being treated each year. These limits on treatment program expansion are only rough estimates of what may be feasible. Mentally moving the points in the above graph along the indicated slopes shows the sensitivity of cost and consumption results to these limits.

Restoring Supply-Control Cuts Reduces Cocaine Consumption Even More



A: Basecase

Cut supply control

B: Source country

C: Interdiction

D: Domestic enforcement

Increase treatment

E: Heavy users

F: More heavy users

G: Light users

Restore supply control

H: Domestic enforcement

I : Interdiction

J: Source country

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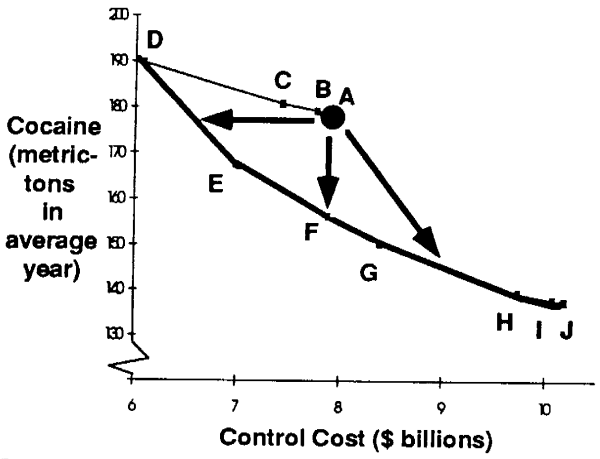
Restoring the supply-control programs in the reverse order from which they were cut extends the range of composite plans to ones costing 2 billion dollars a year more than current cocaine control policies. Cocaine consumption under the most costly plan considered is more than 40 metric tons per year less than what would result from a continuation of current policy.

Intermediate Points Expand the List of Alternative Strategies



A: Basecase

Cut supply control

B: Source country

C: Interdiction

D: Domestic enforcement

Increase treatment

E: Heavy users

F: More heavy users

G: Light users

Restore supply control

H: Domestic enforcement

I : Interdiction

J: Source country

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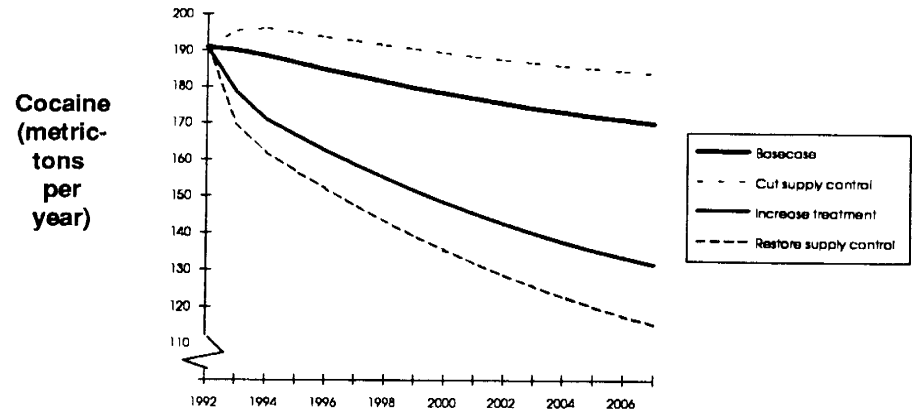
The specific plans plotted in this graph are not the only alternatives to current policy. For example, initially cutting supply programs by a greater amount would shift point D leftward and upward, and adopting larger limits to the expansion of treatment programs would shift points F and G downward and rightward.

Moreover, intermediate plans between those indicated by dots with letters beside them are, of course, possible. For example, the arrow pointing left indicates a plan that spends only a small part of the supply-control savings on treatment thereby holding cocaine consumption at current levels while accomplishing a considerable reduction in the cocaine-control budget. The arrow slanting to the right indicates a plan that restores only part of the domestic enforcement cut, accomplishing as large a reduction in cocaine consumption as possible without greatly expanding the current control budget.

Dynamics of Consumption Change



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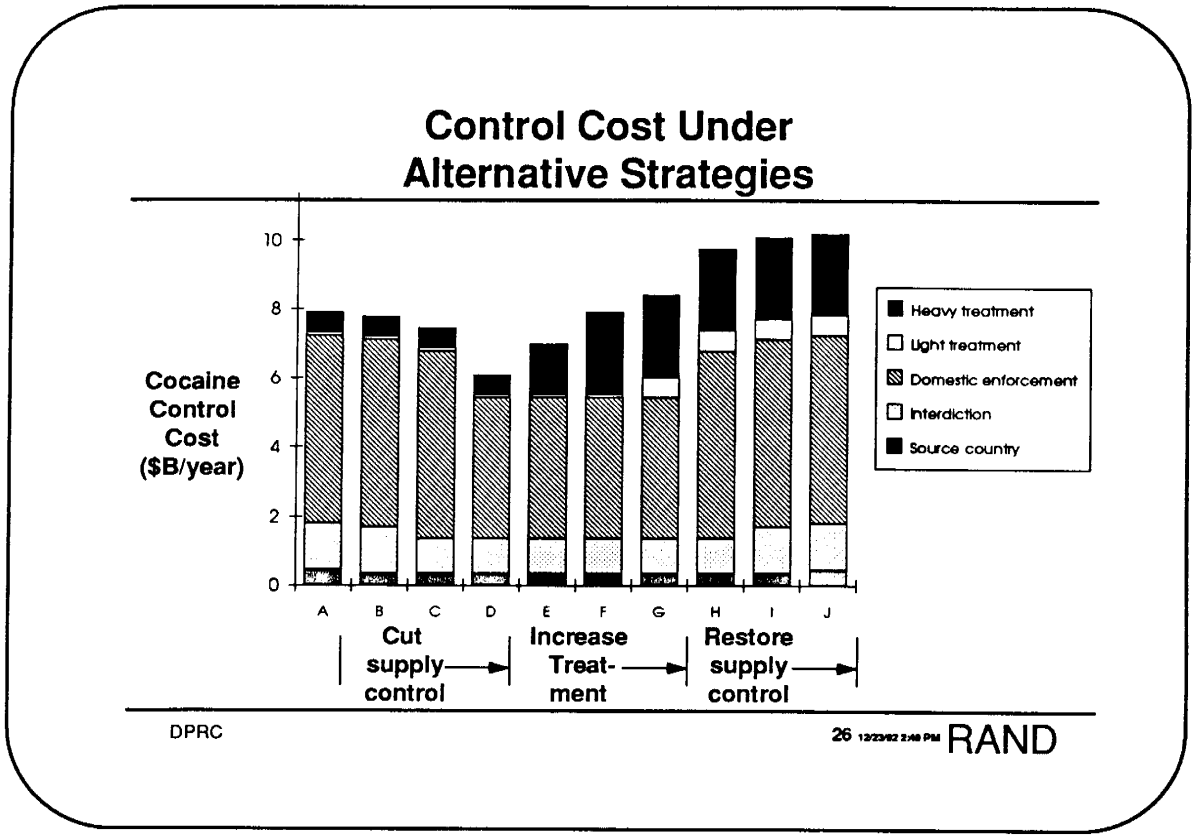
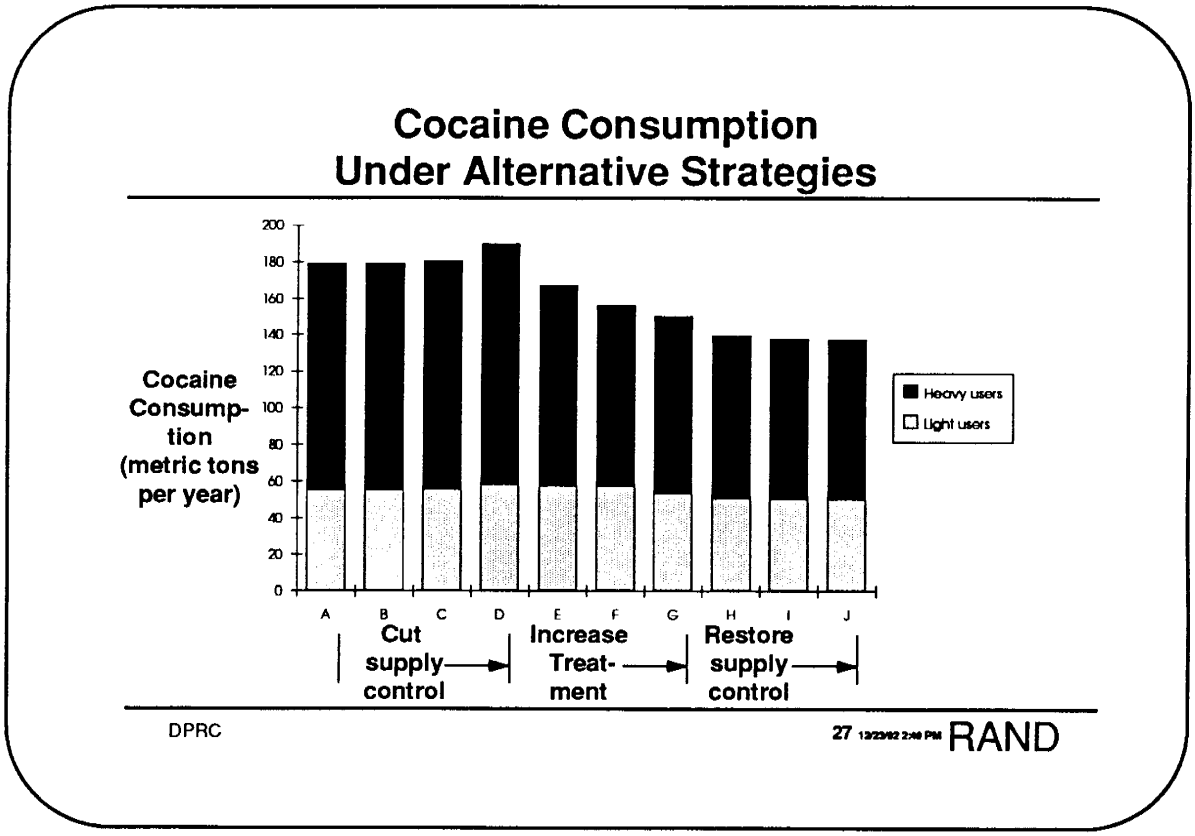
Up to now the presentation has reported average costs and consumption over 15 projection years. Those averages enable an overview of the cost effectiveness of alternative composite strategies. However, by themselves, they tend to create the false impression that the effect of alternative plans is uniform over the projection years. On the contrary, the above graph shows that the differences between the alterative strategies get larger over time.

The thick solid line shows the projected annual consumption levels resulting from current control policies under an assumed incidence scenario that there will be 900,000 new cocaine users per year for the next fifteen years. If the incidence assumption were increased all the lines in this graph would tilt up, and if the incidence assumption were decreased all the lines would tilt down. However, the relative accomplishments of the different strategies (indicated by the distances between the lines) would remain roughly the same.



This presentation has explored alternatives to current cocaine control policy that range in cost from roughly 2 billion dollars below to 2 billion dollars above the current 8 billion dollar annual control budget.



The resulting annual U.S. consumption of cocaine ranges from plus 10 metric tons to minus 40 metric tons about the current 180 metric tons per year.

Note that this is the first chart with the vertical scale starting at zero consumption. Earlier charts looked at the top of the consumption range where the differences in plan performance occur. Even with the considerable expansion of treatment programs that this analysis considers -- while keeping supply control programs funded at current levels -- more than half the cocaine consumption problem remains.