

Expert Panel Discussion

The Nonpharmacologic Treatment of Hypertension: How Effective Is It? An Update

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Following a hypertension symposium in Los Angeles, CA, in October 2006, a panel was convened to update information about lifestyle changes or the nonpharmacologic treatment of hypertension. Dr Marvin Moser, Clinical Professor of Medicine at the Yale University School of Medicine, moderated the panel. Dr Stanley S. Franklin, Clinical Professor of Medicine and Associate Medical Director of the Heart Disease Prevention Program at the University of California, Irvine, and Dr Joel Handler, Director of the Orange County Kaiser-Permanente Hypertension Clinic and clinical hypertension leader of the Care Management Institute of Kaiser Permanente, participated in the discussion. (J Clin Hypertens. 2007;9:209–216) ©2007 Le Jacq

DR MOSER: Stan, lifestyle changes and the nonpharmacologic management of hypertension are recommended by all of the current guidelines as initial treatment for most hypertensive patients. Recommendations are based on a long experience with lifestyle changes, like weight reduction if appropriate, sodium restriction, exercise, alcohol moderation, and so on. What we'd like to do today is to review the benefits and limitations, if any, of some of these.

First, do they help to prevent the development of hypertension in people with blood pressures (BPs) of 120/80 mm Hg to 139/89 mm Hg, a category that was called high-normal and is now labeled prehypertension? Secondly, what are the data on the effects of nonpharmacologic interventions on lowering BP in hypertensive individuals? Is BP lowered enough to reduce cardiovascular events? We are not able to discuss outcomes because there are no controlled long-term outcome studies of any significance with any of these modalities. We will probably never have them because it is unethical in most cases to treat a hypertensive patient without medication, but we can extrapolate and estimate benefit based on the degree of BP lowering. Let's

discuss each of these lifestyle changes that have been shown to affect BP.

DR FRANKLIN: The first question that you asked, Marv, is "How useful are lifestyle interventions in preventing hypertension?" Here I believe that the results can be impressive with effective lifestyle interventions. In terms of the second question, BP is a moving target that increases with age—and the higher the BP, the more difficult it is to reduce it to acceptable levels without starting antihypertensive medication. Using lifestyle modification in individuals with so-called prehypertension (systolic BP 120 to 139 mm Hg and diastolic BP 80 to 89 mm Hg), or high-normal BP (systolic BP 130 to 139 mm Hg, diastolic BP 85 to 89 mm Hg), may help to prevent the development of hypertension, at least in the short term. In the long term, beyond 50 years of age, there is evidence of a gradual further increase in systolic BP (but not diastolic BP) with aging, despite lifestyle intervention. Moreover, effective lifestyle interventions not only lower BP, but also can have beneficial effects in reducing other risk factors favoring cardiovascular disease. The big "if" is whether lifestyle changes can be effectively implemented, and if successful over the short-term, what about the long-term problem of recidivism? This, of course, is the major challenge,



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MODIFICATION	APPROXIMATE SBP REDUCTION, RANGE, MM HG
Weight reduction	5–20 per 10 kg of weight loss
DASH eating plan	8–14
Dietary sodium reduction	2–8
Physical activity	4–9
Moderation of alcohol consumption	2–4

DASH indicates Dietary Approaches to Stop Hypertension.

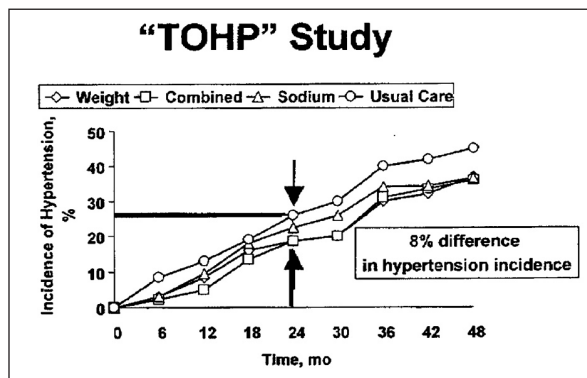


Figure. Effect of weight loss and sodium restriction on development of hypertension compared with a control group. Adapted from Arch Intern Med. 1997;157:657–667.

because changing peoples' lifelong habits can be very difficult, as every physician knows.

DR MOSER: Let's look at a controlled trial where people had nutrition consultants, exercise physiologists, and nurses to help them implement lifestyle changes. Are there any data from this trial to indicate that you could prevent the progression of normotensive to hypertensive levels? The trial that I am referring to is the Treatment of Hypertension Prevention Trial (TOHP).

DR FRANKLIN: Let me describe the design and initial outcome of TOHP. This was a prevention study largely in young adults (mean age, 43 years) with high-normal BP that included 4 therapeutic arms: (1) a weight loss group, (2) a sodium reduction group, (3) a combined intervention group, and (4) a usual care group. Whereas the weight reduction and the sodium restriction arms both lowered BP initially by modest amounts more than the usual care arm, the combination of these 2 interventions had no significant additional effect on BP (Figure).

DR MOSER: Right, Joel, can you describe the long-term effects on BP in the TOHP 4-year study?

DR HANDLER: Generally, what this multimodality intervention trial showed was that with adherence to a rather intense intervention, with exercise counselors and nutritionists and so forth,

you can prevent hypertension in about 8% of patients after 2 years and a somewhat greater percentage at 4 years compared with untreated individuals (Figure). Generally, there is some persistent benefit after the intervention stops, but there is significant recidivism, as Dr Franklin has mentioned. Similar to TOHP, PREMIER was an intense multimodality lifestyle change study that also showed a positive result in reducing BP in patients with prehypertension and stage 1 hypertension over 18 months. However, the question is always whether you can sustain the effect of these interventions.

I am not overly pessimistic about this. I think we still must give a consistent repetitive message to patients to get their weight under control if overweight, to reduce their salt intake, and so on. There was a study several years ago that showed that patients who were able to achieve a significant lifestyle change were more likely to have received a physician message to do so. So, even in the absence of nutritionists and an exercise counselor, a physician message delivered in an appropriate fashion with an empathetic concern for the patient's welfare can be very effective.

DR MOSER: But are you convinced that lifestyle changes can prevent the progression to hypertension?

DR HANDLER: I think they can.

DR MOSER: The TOHP study did show a significant decrease in progression to hypertension in people who followed a lifestyle program. But, as you point out, it was very carefully structured and in the real world this may be difficult. The other trial we might look at is the Trial of Preventing Hypertension (TROPHY) study, which was a study in high-normal or prehypertensive patients with BPs of 130/85 mm Hg to 139/89 mm Hg. They were all advised to follow lifestyle changes, yet 197 of 381 who were not on specific medical therapy progressed to hypertension over a 2-year period compared with only 82 of 391 who were on specific therapy. Nonpharmacologic therapy may, therefore, be useful in preventing hypertension but specific medical therapy appears to be more effective. Let's be more specific. If you had to emphasize to a patient just 2 or 3 things that have been

proven to reduce BP, what would they be, Stan?

DR FRANKLIN: There is no question that effective weight reduction in someone who is overweight or obese has a significant effect on reducing BP.

DR MOSER: Give me an example—if I lost 2 pounds, how much would I lower my pressure?

DR FRANKLIN: Two pounds would not be too effective.

DR MOSER: Statistically, in a large group of patients it would decrease BP by about 1 to 2 mm Hg systolic. What about a 10- to 20-lb weight loss?

DR FRANKLIN: Certainly a 10- to 20-lb weight loss can have a very significant effect on reducing mean systolic BP by approximately 7 to 15 mm Hg, respectively. In individuals who are elderly with increased salt sensitivity, you can achieve an even greater reduction in BP with similar weight loss. The major problems in preventing the development of hypertension in overweight individuals are 2-fold: (1) achieving significant initial weight loss, and (2) preventing subsequent regaining of the lost weight. The table from the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) (Table I) gives an estimate of BP changes for various lifestyle interventions. These are what might be accomplished if people could really follow a program.

DR MOSER: So, the 2 most important interventions that you would employ would be weight loss and sodium restriction.

DR FRANKLIN: They have been proven effective in studies where patients have been instructed on dietary control and low salt intake. It has also been shown that weight reduction is more effective than a low-salt diet in young adults. However, in middle-aged and elderly subjects, there is a significant additive effect of weight reduction and salt restriction on lowering BP.

DR MOSER: But is a low salt intake effective by itself?

DR FRANKLIN: It can be, but the problem is that 75% to 80% of the salt in our diet comes from processed foods. Thus, to effectively reduce daily salt intake requires a major change in what the average person eats. In addition, if people overeat calories, they probably will be overeating sodium as well.

DR MOSER: Of course, when you lose weight, you have a natriuresis the first week or so, but we'll admit that it is very difficult to reduce sodium over the long term. The average person in the United States probably ingests about 10 to 12 g of salt a day. This amounts to about 4 to 5 g of sodium a

Table II. Some Foods With a High Sodium Content That Should Be Avoided

Pretzels, salted crackers, potato chips
Biscuits and pancakes
Fast foods
Olives, pickles, and sauerkraut
Catsup and soy sauce
Many kinds of cheese
Commercially prepared soups or stews
Pastries or cakes made from self-rising flour mixes
Bouillon
Ham, sausage, or frankfurters
Smoked meats or fish
Tomato juice (canned)
Frozen or canned lima beans, peas, spinach, or carrots

Adapted from Moser M. *Clinical Management of Hypertension*. 7th ed. Caddo, OK: Professional Communications; 2005.

day. To what level would this have to be reduced to achieve an effect on BP?

DR FRANKLIN: Well, I think an average reduction of about 40 mmol per day of sodium has been shown to lower systolic BP by 1 to 3 mm Hg. The American Heart Association recommends a 6-g sodium chloride diet or about 100 mmol of sodium per day.

DR MOSER: So, about 2.4 g or about a teaspoon of sodium a day.

DR FRANKLIN: Correct.

DR MOSER: Can we achieve that in the world we live in, with all of the processed foods containing so much sodium? Can people in the real world reduce sodium by 30 to 40 mmol/d without drastically changing their habits?

DR FRANKLIN: That is the problem. The average American consumes a diet that contains an abundance of processed foods (some as fast foods) that are very high in salt content. To make a significant change, one would have to switch to a diet high in fruits and vegetables and low in processed foods, and this requires a major change in dietary habits; in addition, it will be a more expensive diet.

DR MOSER: What if I cut out pickles, frankfurters, salted popcorn, and obviously salted foods, and didn't add salt at the table or in cooking. While I might still eat some processed foods, this intervention should reduce sodium intake by 30 to 40 mmol. We can look at Table II for a partial list of some of the high-sodium foods that could be avoided or eaten less frequently. This might be enough to have an effect on BP.

Table III. How to Estimate Ideal Body Weight*—Examples

Women—height: 5 ft, 5 in	
Allow 100 lb for first 5 ft of height	100
Add 5 lb for each additional inch	+25
Ideal body weight for a 5-ft, 5-in woman	=125 lb
Men—height: 5 ft, 10 inches	
Allow 106 lb for first 5 ft of height	106
Add 6 lb for each additional in	+60
Ideal body weight for a 5-ft, 10-in man	=166 lb
*A variation of between 5 and 10 lb is probably acceptable.	

DR FRANKLIN: Well, certainly some, but by no means all, persons may be able to reduce their sodium intake by 30 to 40 mmol/d if they cut down on the foods noted in the Table. Keep in mind, however, that breads, other baked products, and milk all have a high sodium content—just cutting down on very salty foods and foods with visible salt might not be sufficient to reduce salt intake enough to make a major difference in BP control. In addition, many people eat a substantial number of their meals in restaurants, which generally use liberal amounts of salt in their food. Therefore, to achieve a significant societal reduction in dietary sodium intake will require that the food industry reduce the salt content of processed foods. Currently, only Finland and the United Kingdom have successfully passed laws that force industry to gradually reduce the salt content of processed foods

DR MOSER: But you believe that a decrease of 40 mmol might be enough to affect BP, if you could achieve it? At present, most foods are labeled for sodium content. If we suggest that people don't buy anything that contains more than 150 mg sodium per portion, would that be helpful?

DR FRANKLIN: Yes, it would be helpful. However, I think you're up against the average American diet. Once a person has formed dietary habits, it is difficult for that person to make major changes. A small percentage of the population can do it effectively and maintain it, but if you're talking about the average person, it is very difficult to do.

DR MOSER: So you are not optimistic about a major change. I'm convinced, however, that the degree of sodium restriction that we're talking about can be achieved. It should be noted that in the elderly and in black patients, sodium restriction may be more effective than in whites and younger people.

DR FRANKLIN: Yes, blacks have been shown to be more salt sensitive than whites and salt sensitivity increases dramatically with aging. In addition, there is a yin/yang effect in terms of high-

sodium and low-potassium diets elevating BP. A high-potassium and low-sodium diet is associated with a reduction in BP.

DR MOSER: We'll talk about potassium in a minute. Joel, we know that if you were obese and joined a weight reduction group or worked with a nutritionist, you probably could lose 20 to 30 lb. You might or might not maintain the loss because we know that in the real world, even losing 15 to 20 lb and maintaining the weight loss is difficult. Let's assume that you have a patient in your practice who is obese and who has a systolic BP of 138 to 145 mm Hg and diastolic BP of 85 to 92 mm Hg. This is the kind of patient who would probably benefit from lifestyle changes. What do you tell this patient, what do you do to get this patient to reduce weight, and how often do you succeed? Many physicians are pessimistic about achieving and maintaining weight reduction in their patients. It is discussed, but often given short shift. Perhaps that is why we don't succeed as often as we could.

First of all, it might be useful to use a chart to illustrate ideal weight (Table III). These numbers are approximate and might vary by 5 or 10 pounds but they will give an idea of what someone should weigh. Most physicians and patients don't know these specifics, so a chart like this may be useful. Also, a waist measurement may help to define abdominal obesity. More than 34 inches in a woman or 40 inches in a man strongly suggests this.

DR HANDLER: Well, we have to work with patients and realize that if someone has been overweight for a long time, has tried and failed to lose weight on many different diets, it is probably not a good idea to just give some glib advice and set the patient up for failure again.

DR MOSER: What kind of advice do you give? Assume that you are a solo practitioner, you do not have a nutritionist—what would you suggest to the patient? Is there some kind of a formula that you could use that might work in a reasonable number of people? Cut everything in half? If you like candy and you eat 10 pieces a week, cut it to 5? You like cake and eat 5 pieces a week, cut it to 2? If you eat 10 cookies a day, cut it to 5? Does that ever work?

DR HANDLER: I think that's the kind of detail you need. If you can cut down 300 to 400 calories a day in a consistent fashion and maintain that modification over a period of time, you will lose weight.

DR MOSER: What kind of result? Let's say you can't convince the patient to exercise more, so calories aren't going to be burned up by exercise, but you can get the patient to reduce calorie intake

from 2900 a day to 2600 a day. What do you think would happen over 3, 4, or 5 weeks?

We know that if you decrease calorie intake by more than 3500 a week and keep calorie expenditure the same, you will lose 1 lb.

DR HANDLER: So the patient would lose about 1 lb every 10 days with a decrease of about 300 calories a day.

DR MOSER: The first few days a few pounds are lost because of fluid loss, but then about 1 lb every 10 days. Table IV will give you an idea of what calorie intake is necessary at various levels of exercise to maintain weight. If intake is reduced from these levels, there will be a weight loss. This may also be helpful to show patients.

DR HANDLER: We're always trying to go slow and that's the healthy and practical way. If you can figure out some way to get a patient to reduce intake by 300 to 500 calories/d and follow this carefully with some kind of an action plan, the program might be successful. Contact is important. Sometimes office support systems are helpful.

DR MOSER: But what if you don't have the kind of office that can give this support?

DR HANDLER: If you don't have a nutritionist, you could have your nurse call every few weeks to see how the patient is doing. If they have questions, have them come back in 6 weeks and reevaluate the plan. It takes more than 1 office visit. You have to be practical, you look for small changes and you have to be upbeat.

DR MOSER: So what you're confirming is that achieving weight loss is difficult. We all know that. If you can get someone to exercise, this of course will help in losing weight. If calorie intake is reduced by 300 a day and 200 more calories a day are used up with exercise, weight loss will be faster. Now, what are the expectations?

Let's say the patient does succeed in losing 15 to 20 lb over 3 months. Will BPs come down? And about how much?

DR HANDLER: Based on available data, systolic BP may be reduced by about 5 to 10 mm Hg.

DR MOSER: As we mentioned before, Table I lists what might be expected from various non-pharmacologic interventions. These results, however, have been obtained in structured programs and may be difficult to achieve.

So, let's summarize the effects of weight changes. There is no question that if you stay thin, your chance of getting hypertension is reduced. If you are obese, your chance of having elevated BP is greater. If you have high-normal BPs, the chances of stopping progression to hypertension

Table IV. How to Estimate Calories Needed to Maintain Ideal Body Weight

Multiply ideal weight (not necessarily present weight) by activity level. Example:

Ideal weight, lb	125
Activity level*	× 13*
Total calories needed per day to maintain ideal weight	=1625 calories

*Sedentary activity level is used as the example. Use 15 and 17 for moderately active and very active activity levels, respectively. A sedentary woman whose ideal weight is 125 will require approximately 125 × 13 or 1625 calories/d to maintain her ideal weight. More than this will result in a weight gain. Adapted from Moser M. *Clinical Management of Hypertension*. 7th ed. Caddo, OK: Professional Communications; 2005.

are reasonably good if you lose weight. If you lose weight, there is a good chance that your BP will be lowered. But we all agree that it is difficult to lose weight but definitely worth a try as the most effective nonpharmacologic approach to treatment.

DR FRANKLIN: I'd like to reemphasize the importance of increasing energy expenditure in combination with dietary caloric restrictions to achieve successful weight reduction.

DR MOSER: An important topic. In addition to sodium restriction and weight loss, there are some good data on the effect of exercise on BP. This is not just important in burning calories to help with weight loss. Stan, what else does an increase in exercise accomplish?

DR FRANKLIN: Aerobic exercise has so many beneficial effects on the body that we could spend an entire session talking about them: increased insulin sensitivity, increasing high-density lipoprotein cholesterol, and of course, lowering BP, just to name a few benefits. Since low-calorie diets are challenging, one must also increase energy expenditure with aerobic exercise to have a decent chance for successful weight reduction.

DR MOSER: Let's review that. How many calories do you have to expend with exercise to help lose weight and how is this accomplished? If calorie intake is reduced by 300 calories per day and if the goal is to lose 1 lb a week or the equivalent of 500 calories per day or 3500 calories per week, another 200 calories have to be burned up with exercise. What has to be done to accomplish this, over and above usual activities?

Table V gives you an idea of calorie expenditure for some activities—3 calories per minute walking, about 6 calories per minute with vigorous exercise, and so on. A program can be structured so that

Table V. Calorie Expenditures for Various Activities

ACTIVITY	APPROXIMATE NO. OF CALORIES BURNED PER 30 MINUTES
Household activities	
Gardening	110
Mowing lawn (power mower)	120
Sitting/conversing	40
Vacuuming	130
Moderate exercise	
Bicycling (5–8 mph)	100–150
Bowling	130
Playing golf	100
Swimming (1–4 mph)	150
Walking (1–3 mph)	60–130
Vigorous exercise	
Bicycling (10–15 mph)	200–350
Hill climbing (100 ft/h)	225
Ice skating (10 mph)	200
Jogging (5 mph)	250
Playing tennis	200
Running (8 mph)	360
Skiing (10 mph)	300
Walking (4 mph)	200

Adapted from Moser M. *Clinical Management of Hypertension*. 7th ed. Caddo, OK: Professional Communications; 2005.

someone could burn up 200 extra calories or more a day over and above the basic calories used for sedentary living without too much difficulty.

DR FRANKLIN: I would think that you would need a minimum of 30 minutes, 5 days per week of brisk walking, or 20 minutes, 5 day per week of light jogging to come close to accomplishing this. Keep in mind that you are not only burning calories during the period of exercise but you are also raising your metabolic rate and burning more calories for an extended period of time after you finish exercising.

DR MOSER: Most elderly patients don't want to or can't jog or run because if they did this when they were 40, their knees and hips may not permit it, or they have other problems that will not permit this type of activity. So what do you tell them? Do you believe that just walking 30 to 45 minutes a day, 5 days per week will be enough?

DR FRANKLIN: Right—walking is the best exercise for the middle-aged or elderly individual who has not previously been on an active exercise program. One can also use a stationary bicycle or go to a gym for a variety of exercises, including the use of a treadmill and/or a stair climber. There are

many ways in which individuals can increase their energy expenditure. They can avoid elevators and walk up 1 or 2 flights of stairs if they are able or, for example, park their automobiles several blocks away from their destination.

DR MOSER: When we advocate exercise, therefore, we are not suggesting that this implies jogging or running, weight lifting, or strenuous workouts. If someone likes to do this and is able to, fine, but most people aren't able to engage in these activities. Cardiovascular risk can be reduced and calorie expenditure increased without this approach. Moderate exercise may not improve fitness but will help to reduce CV risk. Joel, if I can get my patient on a weight reduction program and he/she is now walking 30 minutes, 5 days a week, what do you think this exercise component will add to BP lowering?

DR HANDLER: The exercise component of the regimen doesn't kick in immediately. I believe that you see the effects of sodium restriction more quickly, probably within a few weeks, certainly in 1 or 2 months. But when a patient is following an exercise plan, it may take at least 2 or 3 months to note a change in BP. Generally, the expectation for most patients with some variability is that you would expect to see a systolic reduction of about 6 to 7 mm Hg (Table I).

DR MOSER: Does it matter whether a person just walks more or participates in vigorous exercise?

DR HANDLER: Recent studies tell us that you get just as much benefit with BP reduction from a moderate exercise program and reduce your chances of injury that might occur with a more vigorous regimen. What we're trying to do is to get patients to effect a consistent lifestyle change, and a moderate amount of activity doesn't expose them to injury. This provides just as much long-term benefit at lower risk.

DR MOSER: Some exercise physiologists would disagree. There are some data suggesting that vigorous exercise produces more of an effect on BP, but there is, of course, the possibility that many people cannot do it. And many people don't have the money or the time to go to gyms for structured workouts.

OK, so exercise, weight reduction, and sodium restriction combined may reduce BPs in some people who are prehypertensive and in some with pressures of 140/90 mm Hg to 150/95 mm Hg so they do not have to be treated pharmacologically. Anything else that we know that has been proven to lower BP?

DR FRANKLIN: Yes, there's no question that an intake of more than about 2 alcoholic drinks

Table VI. Lifestyle Modifications for Control of Hypertension and/or Overall Cardiovascular Risk

Weight loss, if overweight*
Reduction of sodium intake to <100 mmol/d (2.4 g of sodium or ≈6 g of sodium chloride)*
Limiting alcohol intake to <1 oz/d of ethanol (24 oz of beer, or 10 oz of wine, or 2 oz of whiskey); approximately half of these amounts for women and thin people
Cessation of smoking and reduction of dietary saturated fat and cholesterol for overall cardiovascular health; reduced fat intake also helps reduce calorie intake—important for control of weight and type 2 diabetes
Adequate dietary potassium, calcium, and magnesium intake
Relaxation techniques, biofeedback
Vegetarian diets, fish oil
*These interventions have been found to be effective. Data on other interventions are not definitive. Adapted from <i>Arch Intern Med.</i> 1997;157:2413–2446.

a day for a man or 1 drink a day for a woman of average size can increase BP. There is a progressive increase in both systolic and diastolic BP with increasing alcoholic intake above these limits.

DR MOSER: So if you have someone drinking 4 to 5 drinks a day and you reduce their intake to 1 or 2, if you can, you will usually decrease their BP.

DR FRANKLIN: Usually this is the case.

DR MOSER: All the recommendations of national organizations to achieve the maximum benefit in terms of cardiovascular risk reduction advocate a maximum of 1 to 2 ounces of alcohol per day, which translates to 8 to 10 ounces of wine, about 24 ounces of beer per day, and 1 to 2 drinks of vodka, scotch, and so on. So we can recommend this as being beneficial provided you don't exceed these limits (Table VI).

DR FRANKLIN: For cardiovascular benefit, yes. In comparing teetotalers with individuals with a moderate alcoholic intake, you can also show that there is a decrease in coronary events that is not directly related to BP levels.

DR MOSER: Okay, so weight loss and sodium restriction have proven benefits in reducing BP. Alcohol in moderation is beneficial in keeping CV risk down, and reducing alcohol in heavy drinkers will also help to lower BP. The data on exercising are good and there is evidence that combining these lifestyles changes produces an additive effect. Now what about potassium, magnesium, calcium, and some of the other interventions that have been advocated to reduce BP, like transcendental meditation? Table VI from JNC 7 summarizes the present recommendations for lifestyle modifications.

DR HANDLER: The data are less consistent. Certainly there are data suggesting that increasing dietary potassium can reduce stroke risk.

DR MOSER: If the intake is more than 100 mmol/d.

DR HANDLER: That's right.

DR MOSER: And most of us ingest about 30 to

60 mmol/d. We should probably be getting more potassium than that.

DR HANDLER: We are not recommending potassium supplements and, as you suggest, the dosages are quite high. Data are less consistent than with the other modalities we have talked about.

DR MOSER: Will a high potassium intake lower BP?

DR FRANKLIN: The results of increasing dietary potassium intake in lowering BP have been inconsistent in long-term studies. However, a low dietary potassium intake, such as may be noted in some black individuals and many elderly persons, may predispose to the development of hypertension; in this situation, supplemental potassium in food and/or medication has been shown to lower BP significantly and may protect against stroke.

DR MOSER: Right, there are some short-term studies suggesting that it will, but no long-term data, and you do have to add 40 to 70 mmol/d. BP lowering may be about 3 to 4 mm Hg systolic and 1 to 2 mm Hg diastolic. What about garlic? Does it lower BP?

DR FRANKLIN: I don't think we can recommend garlic in the absence of positive, well controlled, double-blind studies.

DR MOSER: We reported a controlled study. There was no significant effect on BP with a garlic supplement. How about magnesium? It lowers BP when given intramuscularly and pregnant women receive it in toxemia of pregnancy. It is a vasodilator. Is it useful?

DR FRANKLIN: No consistent benefit.

DR MOSER: Anything else? Transcendental meditation—does that work?

DR FRANKLIN: Most of these studies were poorly controlled and have been short-term, not long-term, studies.

DR MOSER: While you are meditating, your BP is lowered but not enough of a long-term effect to recommend it as one of the important interventions.

DR FRANKLIN: What about the Dietary Approaches to Stop Hypertension (DASH) diet? Low in animal fat, high in fruits and vegetables—that incorporates many of the good features of nonpharmacologic therapy.

DR MOSER: There are good data on the DASH diet. There is no question that this diet, which is low in saturated fat and high in potassium, will lower BP. But the DASH diet studies were all feeding trials. Food was supplied to all the participants. Your patients don't get their food delivered 3 times a day, do they? Does your office do that? So, in principle, this is what can be done but it is difficult to do in real life.

DR FRANKLIN: Marv, your comments are well supported. In PREMIER, a large-scale study of the DASH diet in which patients had to buy and self-prepare their food, reduction in BP was minimal, and this correlated with poor adherence to the DASH diet.

DR MOSER: The latest suggestion from some of our colleagues is to use a machine to help reduce your respiratory rate to 10 per minute and lower your BP. This procedure has gotten a lot of publicity from the manufacturers, but most patients can learn to do this themselves. You don't need a machine. Relaxing and controlling respiratory rate can't hurt

and may help. When you reduce your respiratory rate, you reduce your BP—vasodilation occurs. This is like TM or yoga. But, there are no consistent data from well-controlled trials to indicate that these interventions are going to reduce BP over time.

DR HANDLER: This discussion points out an important problem and that is cost. The cost of the DASH diet may be considerably higher than the usual diet that people of low socioeconomic backgrounds are eating. This is one of the problems that has to be taken into consideration when making recommendations.

DR MOSER: The results of the DASH studies indicate what can be done in an ideal situation. BP can be reduced. Using this diet might prevent progression to hypertension if you are normotensive, and probably reduce it enough to convert stage 1 hypertension (140/90 mm Hg to 60/100 mm Hg) to a normotensive level.

So we have some good data on nonpharmacologic interventions. We know that we can do a lot to lower BP in some people without medication. We must try harder to implement what we know but also recognize that most people with hypertension will require some medication to achieve optimal BP levels.

Thank you.