JOHN S. HAGELIN, MAXWELL V. RAINFORTH,
DAVID W. ORME-JOHNSON, KENNETH L. CAVANAUGH,
CHARLES N. ALEXANDER, SUSAN F. SHATKIN, JOHN L. DAVIES,
ANNE O. HUGHES and EMANUEL ROSS

EFFECTS OF GROUP PRACTICE OF THE *TRANSCENDENTAL MEDITATION* PROGRAM ON PREVENTING VIOLENT CRIME IN WASHINGTON, D.C.: RESULTS OF THE NATIONAL DEMONSTRATION PROJECT, JUNE–JULY 1993

(Accepted 6 November, 1998)

ABSTRACT. This paper reports the results of a prospective experiment in which a group of approximately 4,000 participants in the Transcendental Meditation and TM-Sidhi programs of Maharishi Mahesh Yogi assembled in Washington, D.C., from June 7 to July 30, 1993. It was hypothesized that levels of violent crime in the District of Columbia would fall substantially during the Demonstration Project, as a result of the group's effect of increasing coherence and reducing stress in the collective consciousness of the District. A 27-member Project Review Board comprising independent scientists and leading citizens approved the research protocol and monitored the research process. Weekly crime data was derived from database records provided by the District of Columbia Metropolitan Police Department (DCMPD), which are used in the FBI Uniform Crime Reports. Statistical analysis considered the effect of weather variables, daylight, historical crime trends and annual patterns in the District of Columbia, as well as trends in neighboring cities. Consistent with previous research, levels of homicides, rapes and assaults (HRA crimes) correlated with average weekly temperature. Robberies approximately followed an annually recurring cycle. Time series analysis of 1993 data, controlling for temperature, showed that HRA crimes dropped significantly during the Demonstration Project, corresponding with increases in the size of the group; the maximum decrease was 23.3% ($p < 2 \times 10^{-9}$) [24.6% using a longer baseline, with 1988–1993 data ($p < 3 \times 10^{-5}$)], coincident with the peak number of participants in the group during the final week of the assembly. When the same period in each of the five previous years was examined, no significant decreases in HRA crimes were found. Robberies did not decrease significantly. However, a model that jointly estimated the effect of the Demonstration Project on both HRA crimes and robberies showed a significant reduction in violent crimes overall of 15.6% ($p = 0.0008$). Further analysis showed that the effect of the coherence-creating group on reducing HRA crimes could not be accounted for by additional police staffing. The time series analysis for HRA crimes gave

Social Indicators Research **47:** 153–201, 1999.

results that are highly robust to alternative model specifications, and showed that the effect of the group size was cumulative and persisted after the Demonstration Project ended. Also, calculation of the steady state gain based on the time series model predicted that a permanent group of 4,000 coherence-creating experts in the District would have a long-term effect of reducing HRA crimes by 48%.

The United States has higher violent crime rates than all western European nations, despite an incarceration rate seven times higher than the western European average. (International Criminal Police Organization, 1994; United Kingdom Prison Service, 1994). The total cost of crime to U.S. government, citizens, and businesses is estimated at nearly $700 billion annually (Gest, 1994). In Washington, D.C., alone, from 1986–1992 the annual crime budget rose to nearly $1 billion (District of Columbia Government, 1996), yet violent crimes increased 77% during the same period (Federal Bureau of Investigation, 1987, 1993). Juvenile violent crime is predicted to double in the next decade, a major concern since serious violent offending most commonly begins during adolescence (Office of Juvenile Justice and Delinquency Prevention, 1993, 1996; FBI, 1993).

Although recent data indicate a decline in violent crime nationally, levels are still higher than those of a decade ago, particularly in urban areas (Bureau of Justice Statistics, 1997; FBI, 1996). It is also unclear how much of the decrease is due to anti-crime measures, whose effectiveness is a subject of continuing controversy. For example, deterrence measures such as more stringent prison sentences and putting more police on the street, widely publicized during recent Congressional debates, have not yet been proven to reduce crime (Petersilia, 1993; Kelling et al., 1974; Police Foundation, 1981; Sherman et al., 1997; Reiss and Roth, 1993; Mauer, 1995). Moreover, the costliness of such measures – e.g., $5.5 billion to build enough new prisons to fulfill California's "three strikes" law – makes full implementation unlikely (Greenwood et al., 1994). The effectiveness of preventive measures has likewise not been clearly established. For example, a recent National Institute of Justice-commissioned review of over 500 crime prevention programs, supported by $3 billion in federal funds, concluded that, due to a lack of rigorous scientific evidence, "by scientific standards, there are very few programs of proven effectiveness" (Sherman et al., 1997).

Social Stress, a Fundamental Cause of Crime

Linsky and Straus (1986) showed that the level of social stress is a potent factor in crime. Their State Stress Index (SSI) – an index of economic, family, and other stressors including unemployment, bankruptcy, divorce, infant mortality, high school dropout rate, and new welfare cases – correlated very highly with rates of violent crime (between 0.68 and 0.72 for homicides, rapes, and aggravated assaults). Correlations have been found by other researchers between homicides and the SSI (Lester, 1996), and between violence and components of the SSI (e.g., unemployment and divorce rates: Brenner, 1976, 1980; Leenars and Lester, 1994).

These findings on the macrosocial level are consistent with research linking stress and violence on the individual level. Stressful and traumatic experiences early in life have been identified as risk factors for later criminal behavior. These include maternal rejection, parental neglect and child abuse, and instability and violence in the family (American Psychological Association, 1993; Raine et al., 1994, 1996; Peppler and Rubin, 1991; Lewis et al., 1989). High life-events stress is also associated with domestic violence and with aggressive behavior, delinquency, and crime among youth (Vaux and Ruggerio, 1983; Straus, 1980; Attar et al., 1994). More serious offenses are associated with more intense levels of stress (Humphrey and Palmer, 1986).

Controlled experiments in laboratory animals have supported the link between stress and aggressive, violent behavior, and have delineated possible mediating neuroendocrine mechanisms (Ferris and Grisso, 1996; Sapolsky, 1992). Animal and human studies have shown that chronic stress disrupts the coordinated regulation of the neurotransmitter serotonin and key hormones, including cortisol, impairing the individual's ability to respond adaptively, and in many cases causing serious physiological malfunction. Specifically, chronic stress produces abnormally low levels of serotonin, as well as abnormally high levels of cortisol, changes which have been directly correlated with aggression, hostility, and impulsive, violent behavior (Sapolsky, 1996; Walton and Levitsky, 1994; Seeman and McEwen, 1996; Virkkunen et al., 1989; Pope and Smith, 1991; and see for a review MacLean et al., 1996).

The principle of individual and social stress as a fundamental cause of crime is compatible with other prevalent theories of the etiology of crime, for example: social strain theory (Merton, 1938) focuses on economic frustrations leading to crime; social disorganization theory (Shaw and McKay, 1942) targets family and community disintegration as a source of societal stress; and labeling theory highlights the stressful impact of branding children as delinquents (Tannenbaum, 1938).

Reducing Crime through Reducing Social Stress

Social stress is a complex, multi-dimensional problem, involving such highly interrelated social problems as crime, drug abuse, ill health, unemployment, and poor educational performance (cf. Linsky and Straus, 1986). Its pervasiveness is shown, for example, in the fact that 44% of Americans suffer from stress-related health problems (U.S. Department of Health and Human Services, 1994). Given the epidemic proportions and multidimensionality of social stress, treating any component in isolation is likely to be only partially effective.

However, any concerted effort to reduce crime by addressing the multiple dimensions of social stress (for instance through effective drug abuse prevention and job training, and improving educational performance) implies large-scale direct intervention across a broad spectrum of social institutions (cf. Dillbeck et al., 1988). Even if only high-risk communities were targeted, this would be a very costly undertaking. Thus it is critically important to identify approaches that are: (a) proven to reduce individual and social stress and (b) practical and cost-effective to implement widely.

The Transcendental Meditation *and* TM-Sidhi *Programs: An Effective Approach to Reducing Stress in the Individual and Society*

One approach found highly effective in reducing both individual and social stress is the Transcendental Meditation® and TM-Sidhi® programs, founded by Maharishi Mahesh Yogi.[1] In the past 36 years, more than four million people around the world have learned the Transcendental Meditation (TM®) technique, described as a simple, effortless technique to promote full development of human consciousness, which is practiced for 15 to 20 minutes morning and evening while sitting comfortably with the eyes closed (Roth, 1994).

Over 600 research studies conducted during the past 25 years at more than 200 universities and research institutions in 30 countries have investigated the effects of these programs on improving the quality of life in the individual and society (Orme-Johnson and Farrow, 1977; Chalmers et al., 1989a, 1989b, 1990; Wallace et al., 1990, in press). This research has found a broad range of improvements, including reduced stress, improved physical and psychological health, and enhanced learning ability, IQ, and social behavior (for a review of this research, see Alexander, Robinson, Orme-Johnson, et al., 1994; Alexander, Robinson, and Rainforth, 1994; Cranson et al., 1991; also see Orme-Johnson, 1987).

TM practice is associated with a distinctive physiological state of restful alertness (Wallace, 1970), indicated by decreased respiration rates, blood lactate, and basal skin conductance levels (Dillbeck and Orme-Johnson, 1987), and increased coherence and integration of brain functioning (Dillbeck and Bronson, 1981; Lyubimov, 1992). This profound rest promotes regulation of cortisol and other hormones in the opposite direction to chronic stress, including: reduced baseline levels of cortisol, a more robust cortisol response to acute stress, and healthier regulation of serotonin (MacLean et al., 1996); as well as decreased plasma cortisol, catecholamines, and aggressive behavior in hyperaggressive patients (Subrahmanyam and Porkodi, 1980).

These reductions in stress translate into improvements in psychological well-being, growth and maturity, and social behavior. Statistical meta-analyses and random assignment studies have found TM practice more effective than other treatments in decreasing trait anxiety and anger, enhancing emotional balance, and reducing substance abuse and post-traumatic stress disorder (Dillbeck and Orme-Johnson, 1987; Eppley et al., 1989; Alexander et al., 1991; Dillbeck and Abrams, 1987; Alexander, Robinson, and Rainforth, 1994; Brooks and Scarano, 1985).

Such individual benefits appear to positively impact crime, as indicated by research conducted on maximum security prisoners. Inmates who practice the Transcendental Meditation technique display reduced psychopathology, hostility, rule infractions, and post-release recidivism (Abrams and Siegel, 1978; Dillbeck and Abrams, 1987; Bleick and Abrams, 1987; Rainforth et al., in press). The technique has also been shown to remediate risk factors for criminal behavior, including aggression, low ego development (Alexander et al., in press) and moral reasoning (Nidich et al., 1983), and poor cognitive performance among socially disadvantaged youths (Dillbeck et al., 1990).

Collective Consciousness-Based^{SM} *Approach to Crime Reduction*

Consistent with these effects at the individual level, collective practice of the Transcendental Meditation and TM-Sidhi programs is predicted to produce positive changes in society as a whole. This Consciousness-Based approach, an aspect of Maharishi Vedic Science and Technology^{SM} (Maharishi Mahesh Yogi, 1995), can be summarized as follows.

Maharishi (1978) maintains that a society is characterized by the quality of its *collective consciousness*, which arises from the consciousness of all its members taken together, and reciprocally influences individual behavior. Rising stress in the lives of individuals increases stress in collective consciousness, which is reflected in violence, crime, and other social problems. Conversely, increasing the level of coherence and harmony in collective consciousness positively influences individual behavior, and thus is a practical means to improve the quality of life in society and solve recalcitrant social problems.[2]

During the Transcendental Meditation technique (Maharishi, 1995) the mind is said to systematically and effortlessly settle down to its own simplest form of awareness, a restfully alert state of inner wakefulness known as *pure consciousness*, which is not only an inner subjective experience, but held to be an intersubjective field universal to individuals. Maharishi describes pure consciousness as the most basic field of nature's intelligence, which is the source of all the order and intelligence displayed throughout the universe; Hagelin (1987, 1998) has proposed that this same underlying field of intelligence is identical to the unified field posited by quantum field theorists.[3]

On this basis it is predicted that the experience of pure consciousness can generate extended field effects, similar to those achieved in physical systems, that can propagate throughout a social system. Specifically, it is proposed that collective stress can be alleviated, and social coherence increased, through field effects of human consciousness projected from this universal level of natural law (Maharishi, 1996; Hagelin, 1998).

Maharishi proposed more than 30 years ago that a small number of individuals – one percent of a population – practicing the Transcendental Meditation technique individually would create an influence of coherence throughout collective consciousness.[4] An even stronger coherent influence is said to be generated when a group of individuals gathers together to practice the TM-Sidhi program, a set of mental techniques learned by advanced TM practitioners. Whereas TM practice brings the mind into contact with pure consciousness, the objective of the TM-Sidhi program is to train the mind to consciously function from pure consciousness, in order to amplify and accelerate the integration of pure consciousness into the individual mind (Maharishi, 1995; for review of theory and research, see Gelderloos and van den Berg, 1989). The TM-Sidhi program relative to TM alone has been found to produce immediate and long-term increases in EEG coherence, to enhance neurological efficiency, to improve efficiency of concept learning, and to increase endocrinological efficiency and balance (Travis and Orme-Johnson, 1990; Orme-Johnson et al., 1989; Wallace et al., 1983; Werner et al., 1986). Since the individual is held to be the unit of collective consciousness, the more powerful effects of the TM-Sidhi program on individual behavior are predicted to have sociological correlates as well. Hence, it is proposed that group practice of the TM-Sidhi program by an even smaller number of individuals – the square root of one percent of the population – will produce a society-wide transformation (Maharishi, 1996). This proportion is based on physical models of how a few coherent elements in a physical system (e.g., a laser) can stimulate phase transitions to coherent functioning in the entire system; since the combined intensity of coherent elements is proportional to the square of their number, a measurable influence on the whole system can be expected when a coherent subpopulation exceeds a number proportional to the square root of the total population (Hagelin, 1987: p. 65). Such groups of TM-Sidhi participants are therefore referred to as *coherence-creating* groups.

Previous Research on Collective Effects of the Transcendental Meditation *and* TM-Sidhi *Programs*

This predicted influence of collective practice of the Transcendental Meditation and TM-Sidhi programs has been tested by over 40 studies on a variety of social indicators; 15 of these studies have investigated crime as an outcome variable. This phenomenon, termed the Maharishi Effect by researchers in honor of Maharishi who first predicted it, has been subjected to increasingly rigorous examination over the course of two decades – through greater sophistication of statistical methodology, investigation of larger statistical samples, comprehensive control for factors affecting the dependent variables, replication across outcome variables and geographic locations, and employment of prospective research protocols.

Urban crime studies on the Transcendental Meditation technique: In the first of many studies published in peer-reviewed journals (Dillbeck et al., 1981), crime rates in the first 24 U.S. cities in which at least 1% of the population had learned the Transcendental Meditation technique were compared to control cities matched by an independent investigator. Total crime decreased 16% in the "1% cities" compared to the control cities, controlling for key demographic variables. Over the next five years, crime rate trend was also significantly reduced in the 1% cities compared to controls. The scope of investigation was subsequently broadened to two random samples of 160 cities and 80 Standard Statistical Metropolitan Areas comprising almost half the U.S. urban population (Dillbeck et al., 1988). Cross-lagged panel analysis showed that the percentage of the population practicing the Transcendental Meditation technique was correlated with reduced crime over the next seven years. Consistent with a causal interpretation, changes in crime did not predict increased TM participation in subsequent years, and other variables known to influence crime could not account for the results.

Research on group practice of the Transcendental Meditation and TM-Sidhi programs: A series of prospective studies using the statistical procedures of time series analysis have shown significantly reduced crime (either total crime or violent crime), replicated at the metropolitan, regional, state, and national levels in many parts of the world, during assemblies where there were sufficient numbers of TM-Sidhi program participants to produce the predicted effect (Dillbeck et al., 1987, 1988; Orme-Johnson et al., 1988; Dillbeck, 1990; Hatchard et al., 1996).[5]

Previous findings in Washington, D.C.: In Washington, D.C., Dillbeck et al. (1988) found a highly significant relationship between increased attendance in coherence-creating groups in Washington and reduced levels of violent crime. The study reported an 11% decrease in violent crime in one year, with the largest decrease occurring in periods when attendance was highest. The analysis showed that other factors, including weather, police coverage, population age changes, and Neighborhood Watch programs, did not account for this reduction in crime. During the entire period from 1981 to mid-1986, when coherence-creating groups were located in Washington, violent crimes decreased by 35%. As noted above, in 1987 after the group left, violent crime in the District increased substantially.

The National Demonstration Project: A Prospective Study of Violent Crime in Washington, D.C.

This paper reports findings of a two-month prospective experiment, the *National Demonstration Project to Reduce Violent Crime and Improve Governmental Effectiveness* (the "Maharishi Group for a Government") held in Washington, D.C., from June 7 to July 30, 1993. This experiment, conducted by the Institute of Science, Technology and Public Policy at Maharishi University of Management, assembled a group of nearly 4,000 experts in the Transcendental Meditation and TM-Sidhi programs in the nation's capital. The research protocol was lodged in advance with the national and international news media and with a 27-member independent Project Review Board comprising sociologists and criminologists from leading universities, representatives from the District of Columbia

Metropolitan Police Department (DCMPD) and the District government, and civic leaders (Institute of Science, Technology and Public Policy, 1993). The functions of the Project Review Board were to advise the Institute on the research design and monitor the research process. Based on prior research, it was hypothesized that group practice of the Transcendental Meditation and TM-Sidhi programs would substantially reduce violent crime in the District of Columbia. This prospective study was therefore a highly publicized, critical test of the Transcendental Meditation and TM-Sidhi programs as a crime prevention strategy.

METHOD

Data

The independent variable in this research is the number of participants in the Transcendental Meditation and TM-Sidhi programs in Washington, D.C., throughout the duration of the Demonstration Project. The number of participants increased in three tiers over the eight weeks of the project, from approximately 1,000 to 2,500 to 4,000. Participants were housed in hotels and college dormitories at 8 locations around the District and at the University of Maryland. Participants collectively practiced the TM-Sidhi program twice daily in halls set aside for this purpose at each of the housing locations.[6] Several alternate ways of specifying the independent variable were examined – the total number of participants, the total number squared, and the number in each housing area squared and then added – and all were highly intercorrelated (0.96 to 0.99). Because the theory specifies that the effect of such coherence-creating assemblies varies as the square of the number of participants, the analyses reported below used the total number of participants in the Transcendental Meditation and TM-Sidhi programs squared.

The primary outcome was violent crime. As defined by the FBI Uniform Crime Report (UCR) program (Federal Bureau of Investigation, 1994), violent crime consists of homicides (murder and non-negligent manslaughter), forcible rapes, aggravated assaults and robberies. The DCMPD provided computerized database records for reported offenses (the same records from which the DCMPD compiled the official annual UCR statistics for the FBI). This data was requested for 1993 and the preceding five years (1988–1992). To provide daily counts of each type of crime for the analysis, these database records were tallied by occurrence date for each offense, for each category of violent crime. So that these statistics would be consistent with the UCR monthly totals reported by the DCMPD to the FBI, the daily counts were compiled according to DCMPD procedures for UCR reporting. These procedures took into account records updating previously reported offenses, as well as differences in offense categorization used for the UCR versus those used by the DCMPD for its own purposes.

Also, a number of potential control variables were examined in an attempt to exclude confounding factors that could provide alternative explanations for any changes in crime that occurred during the Demonstration Project.[7] Potential confounding factors that were considered included seasonal crime cycles, weather variables (temperature, precipitation, humidity), daylight hours, changes in police and community anti-crime activities, prior crime trends in Washington, D.C., and concurrent crime trends in other cities on the East Coast. (For further rationale on the choice of these control variables, see Hagelin et al., 1994.)

Statistical Analysis

As previously specified in the research protocol, effects of the Demonstration Project were assessed by time series analysis. Box-Jenkins time series methodology has become the standard for rigorously estimating intervention effects on a dependent variable over time (McCleary and Hay, 1980). In this study, constructing a time series model of violent crime in Washington, D.C., provides a dynamical description that takes into account its past history, including trends and cycles. The model can also incorporate the influence of extrinsic, or exogenous, variables known to affect crime, thus statistically controlling for confounding influences.

It might appear that the effect of anti-crime measures could be evaluated by simply comparing crime during the intervention with the same period during the previous year. However, this approach does not control for exogenous influences; it also ignores recent crime trends (e.g., due to broad social conditions) which may account for changes in crime levels since the previous year. It is particularly important to take recent trends into account when the intervention is brief, as in the current study.

The time series model for the dependent variable comprises three major components: exogenous control variables, the noise model, and the intervention effect. All the variables in the time series model, including dependent, intervention, and control variables, consist of data series formed by weekly aggregation; it is well known that aggregation over time reduces the level of noise as a proportion of the mean level of the series and often leads to more parsimonious models (Granger, 1990).[8]

Standard Box-Jenkins methodology (Box and Jenkins, 1976) for identification, estimation, and diagnosis of the time series model was applied to the data for HRA crimes and for robberies using the SCA statistical software package (Liu et al., 1986). Applying this statistical methodology removes any trends and cyclical behaviors in the data in order to arrive at a stationary, time-invariant model of the dependent variable.

A first step in constructing the time series model was to examine the seasonality of violent crime in the District of Columbia. Of the 16,888 violent crimes reported in 1993, 2.7% were homicides, 1.9% were rapes, 53.3% were assaults, and 42.1% were robberies. Studies by the U.S. Department of Justice (Bureau of Justice Statistics, 1988) and others have previously indicated that the highest levels of homicides, rapes, and assaults occur during the summer months. This seasonal pattern is attributable to seasonal variations in temperature: numerous studies have found that higher temperatures are strongly correlated with assaults (e.g., Harries, 1990) and also correlated (although less strongly) with homicides (Castaneda, 1991), rapes (Michael and Zumpe, 1983), and violent crime in general (Cotton, 1986; for a review, see Cheatwood, 1995). However, the seasonal pattern for robberies is different: the maximum number of robberies occurs in December and the least in late spring/early summer (Bureau of Justice Statistics, 1988).

Similar results were found in the present study of Washington, D.C. (discussed below). Because of this difference in seasonal pattern, homicides, rapes, and assaults (which are violent acts intended to inflict bodily harm) were aggregated into one outcome variable (HRA crimes), while robberies (which in contrast are predominantly profit-motivated) were analyzed separately. A further rationale for aggregating the first three variables was that, since homicides and rapes constituted such a small proportion (less than 5%) of total violent crime in Washington, D.C. in 1993, it seemed more meaningful to examine them in the context of a broader indicator of violent crimes against the person (i.e., HRA crimes). Moreover, statistically significant patterns are generally more visible in aggregated variables, as random noise in separate variables tends to cancel out when they are summed together. However, homicides, rapes and assaults were also analyzed separately to determine the degree to which each category contributed to any observed changes in HRA crimes overall.

The next step (prior to subsequent time series analysis of the outcomes of the Demonstration Project) was a preliminary, stepwise regression analysis to determine which control variables should be included in the time series models for each of these two crime variables. To investigate the relationships between crime and control variables independently of 1993 data, the stepwise regression analysis was carried out based on data for the preceding five years (1988–1992). This analysis identified the control variables that best predict HRA crimes and robberies in Washington, D.C., during this period. (Additional police and community anti-crime activities were not considered at this stage, because data for them was available only for 1993.)

For HRA crimes during 1988–1992, temperature was the only significant control variable in the final model from the stepwise regression. To eliminate the possibility that this significant relationship between HRA crimes and temperature was due to spurious correlation (Granger and Newbold, 1974), the regression model was extended to a full time series model of 1988–1992 HRA crime data. In this time series model, temperature was found to be a potent predictor for weekly HRA data ($p < 3 \times 10^{-16}$).[9] Therefore, the subsequent time series analysis of the Demonstration Project in 1993 explicitly controlled for variations in average weekly temperature.

To investigate whether HRA crime trends in Washington, D.C., tend to be related to crime trends in other major cities in the same region, monthly crime data was examined for 1988–1992 from New York and Philadelphia, as well as from Washington. However, after seasonal patterns were removed, crime trends in these cities were found to be uncorrelated with those in Washington, and hence were not included in the subsequent time series analysis.

While HRA crimes vary seasonally every year, a plot revealed a much steeper increase in the first few months of 1993 compared to the same period in previous years. Further examination showed that there was a change in the relationship between crime and temperature near the beginning of 1993. This relationship was assessed by a regression analysis with HRA crimes as the dependent variable and temperature as the independent variable. This analysis indicated that, for example, during January to May 1992, a rise in temperature of 10 °F predicted an average weekly increase of 14 HRA crimes; however, over the same period in 1993, the same rise in temperature predicted a substantially larger increase in HRA crimes (20 crimes per week) – 41% more than the previous year. A structural break test (Johnston, 1984) formally confirmed the change in relationship between crime and temperature by showing a time discontinuity in the structure of the regression model of HRA crimes for 1993 versus the preceding five years ($p < 0.0005$).[10] In view of this structural change, the subsequent time series analysis of HRA crimes was based on 1993 data. (See, however, additional time series analysis using a longer baseline with data from 1988–1993, also reported in Results section.)

A similar preliminary analysis using stepwise regression was also conducted for robberies during 1988–1992, but no control variable was found to be significant. However, to investigate whether there was a consistent annual seasonal pattern for robberies, weekly robberies data was averaged over corresponding weeks from 1988 to 1991 (i.e., an average was computed for the first week of all four years, and for the second week, etc.). A regression analysis found that this annual pattern variable was a significant predictor of robberies in 1992 ($p < 0.025$). Therefore the time series analysis for robberies in 1993 used weekly robberies averaged over 1988–1992 as a control variable.

Time series methodology controls for serial dependence of observations, trends, or seasonal cycles in the data over time, by including these influences in a "noise model" of the series that serves as the null hypothesis in the analysis of intervention effects (McCleary and Hay, 1980). Only after these endogenous dynamics of the dependent variable (as well as any exogenous control variables) are modeled, is the independent variable (the intervention) deemed to have a statistically significant influence.

A standard feature of Box-Jenkins time series modeling is the examination of dynamical relationships between variables, including lagged effects. According to the methodology prescribed by McCleary and Hay (1980), an intervention may have an abrupt or gradual onset, and a temporary or permanent effect. In the present study, because the Demonstration Project was a temporary intervention, it was expected to produce a temporary effect on violent crime. The analysis investigated whether the intervention effect was abrupt in its onset (with no carry-over effects to later time periods), or whether in addition to an immediate influence there was a gradual and cumulative build-up and gradual decay. This possibility was addressed by building a decay parameter into the transfer function for the intervention variable. The role of the decay parameter is to estimate the rate of decay of intervention effects in any given week over subsequent time periods, in a gradually diminishing pattern, thus allowing for a cumulative effect of the intervention as it continues over several weeks.

An objective procedure for time series model selection was followed, based on minimizing the Akaike Information Criterion (AIC), subject to the requirement that model diagnostics were satisfactory. The AIC optimally balances competing goals of parsimony (least possible number of model parameters) and precision of model fit (smallest residual variance: Larimore, 1983; Larimore and Mehra, 1985). Shibata (1983) demonstrates that the AIC "satisfactorily balances both underfitting and overfitting risks, and is asymptotically efficient for selecting one model from a family of models, each specified by many parameters." Because the AIC is proportional to the sample size used in estimation, all alternative models of the same weekly data set were estimated using the same number of observations to allow precise comparisons across model structures. For diagnostic purposes, the autocorrelation structure of residual noise from the model was examined up to a lag of 12 weeks.

After HRA crimes and robberies were modeled separately (as discussed above), the equations for the two models were jointly estimated using the simultaneous transfer function feature of SCA (Granger and Newbold, 1977). This permitted investigation of effects on violent crime as a whole, by examining, in the combined model, the joint significance of the intervention parameters from the two separate models using a likelihood ratio test (Nelson, 1976). In the next section, results are reported for the two models estimated separately, as well as for the test of joint significance.

Although it would have been possible to merely total HRA crimes and robberies into a combined index and then model total violent crime as a univariate series, this approach tends to blur estimation of the influence of any exogenous control variables, cyclical dynamics and time trends (Granger, 1990). Thus jointly estimating the two models for HRA crimes and robberies increases statistical power to discriminate the impact of the Demonstration Project, based on separately modeling the different dynamical behavior of the two components of violent crime.

RESULTS

Time Series Analysis of Homicides, Rapes, and Assaults

Table I shows the empirically constructed model for HRA crimes, which was selected to yield the lowest AIC among all models with the given intervention and exogenous control variables. All parameter estimates in the model were statistically significant; temperature and the coherence-creating group size were highly significant. These results indicate that HRA crime levels tended to increase as temperatures rose; however, despite unusually high temperatures during the Demonstration Project, crime decreased as the group size increased. Reported p values for parameter estimates are based on two-tailed tests for all noise model parameters; one-tailed tests are reported for intervention parameters and temperature since the direction of these effects is clearly predicted.

The empirical model building procedure led to the following final equation:

TABLE I

Parameter estimates for base model (1993 HRA crimes)

Parameter		Variable	Description	Lag	Estimate	t(40)	
1	C		Constant		66.0075	13.08	**
2	α	$TEMP_t$	Temperature	0	1.9768	24.97	**
Intervention Parameters (Coherence-Creating Group Size):							
3	ω	S_t^2	Immediate impact[a]	0	−1.3887	−8.33	**
4	δ	S_t^2	Decay parameter[b]	1	0.9072	80.58	**
Noise Model Terms:							
5	ϕ_2	n_t	AR	2	−0.2843	−2.42	*
6	ϕ_3	n_t	AR	3	−0.2622	−2.17	*
7	ϕ_5	n_t	AR	5	−0.6089	−4.87	**

$^*p < 0.05$; $^{**}p < 0.0001$ (Two-tailed for noise parameters).

[a]Numerator parameter of the transfer function for the intervention (where the group size squared was divided by 1 million to assist in convergence of iterative procedures for estimation of the model parameters).

[b]Denominator parameter.

Ljung-Box test of joint significance of residual autocorrelations:

Lags 1–12, $\chi^2(9) = 7.1, p > 0.62$

$R^2 = 0.858$

Effective N = 47

Residual S.E. = 12.44

AIC = 250.942

$$\begin{aligned} HRA_t &= C + \alpha TEMP_t + \omega/(1-\delta B)S_t^2 + \\ &\quad 1/(1-\phi_2 B^2 - \phi_3 B^3 - \phi_5 B^5)n_t \end{aligned}$$

where the variables in this model are denoted by HRA_t (the dependent variable during week t), $TEMP_t$ (average weekly temperature), S_t^2 (the square of the total number of participants in the Demonstration Project), and n_t (the serially uncorrelated random disturbance term, to take account of random fluctuations in HRA crime levels), and B is the backshift operator defined by $B^k X_t = X_{t-k}$ for any time series X_t.[11] Other symbols represent model parameters: C is a constant term (required to accurately predict the average HRA crime level); ω, the numerator parameter for the transfer function for the intervention, measures the immediate (lag 0) impact of the intervention on violent crime; and δ, the denominator (decay) parameter, models a diminishing effect of the intervention – specifically, a geometric decay with the passage of time (McCleary and Hay, 1980: pp. 154–160). If the estimated decay parameter δ were found to be zero (effectively eliminating the denominator in the transfer function for the intervention), the model would predict an immediate, abrupt onset of the effect of the Demonstration Project, with no carry-over effects to later time periods.

Average weekly temperature was a potent predictor of weekly HRA crimes in 1993 ($p < 3 \times 10^{-26}$). That temperature is highly significant cross-validates the finding that it predicts HRA crime levels in previous years.

The noise component of the model, which statistically controls for the endogenous dynamics of the dependent variable, included statistically significant autoregressive (AR) terms at lags 2, 3, and 5 ($p < 0.025$, $p < 0.04$, and $p < 0.00002$ respectively). The autoregressive terms describe the serial dependence of the data on past values of the series.

Successful removal of trends and cycles was evidenced by the fact that residuals from the noise model satisfied the requirements for a stationary, serially uncorrelated white noise process (Box and Jenkins, 1976). This was indicated by the apparent stationarity of the time plots of the residual error values (i.e., actual HRA crimes minus values predicted from the models); moreover, absence of significant residual autocorrelations up to lag 12 weeks also indicate that no time-dependent structure was left unaccounted for by the models. After temperature was included in the model, further filtering of the data, such as differencing (subtracting the previous time point from the current time point) to remove trends, was therefore not required to achieve stationarity. Also, lack of evidence of significant seasonality in the residuals indicates that the inclusion of temperature in the model successfully accounted for the seasonal variation in crime levels.

Formal diagnostic tests for the statistical adequacy of the model were satisfactory. Inspection of the estimated autocorrelation and partial autocorrelation functions for model residuals indicated that the models accounted for all the time-dependent structure in the data. Ljung-Box Q statistics (LBQ – see Table I), which provide a formal test of this assumption, failed to reject the null hypothesis of uncorrelated residual white noise ($p > 0.63$). All roots of the time series model were outside the unit circle, as is required for stationarity.

Highly statistically significant results were found for each of the other model components, mandating their retention in the model: the constant term ($p < 5 \times 10^{-16}$), the coherence-creating group size squared (immediate effect, ω: $p < 2 \times 10^{-10}$; and the decay parameter, δ: $p < 4 \times 10^{-46}$). As well, a likelihood ratio test (Nelson, 1976) indicated that the two intervention parameters were jointly highly significant ($p < 2 \times 10^{-9}$). The estimated value of the decay parameter, approximately 0.91, was also significantly different from 1.0 ($p = 2 \times 10^{-10}$), consistent with a stable model. This indicates that 91% of the effect due to the group size carried over to the following week, about 82% carried over after 2 weeks, and 68% carried over after 4 weeks. This gradual diminishing of the intervention effect (indicating that reduced crime levels continued after the end of the Demonstration Project) is also seen to some degree in other studies on the societal effects of group practice of the TM-Sidhi program (e.g., Dillbeck and Rainforth, 1996; Dillbeck et al., 1987) (see, however, further comments in Results and Discussion).

Figure 1 plots the data for actual HRA crime levels in 1993 (dark solid line). It also plots (light solid line) the predictions (or "fitted values") from the time series model for HRA crimes reported in Table I, which both models actual crime prior to the Demonstration Project and estimates the effect of the coherence-creating group on crime. The dotted line shows the levels of HRA crime that would have been predicted to occur in the absence of the coherence-creating group (calculation of these predicted levels is explained below). The shaded area indicates the period of the Demonstration Project.

It can be seen that the base model (light solid line) is quite accurate in predicting actual crime (dark solid line) before the Demonstration Project, when the group size was zero. For example, the time series model partially predicts the dip in crime in mid-May, which was due to unusually cool days.

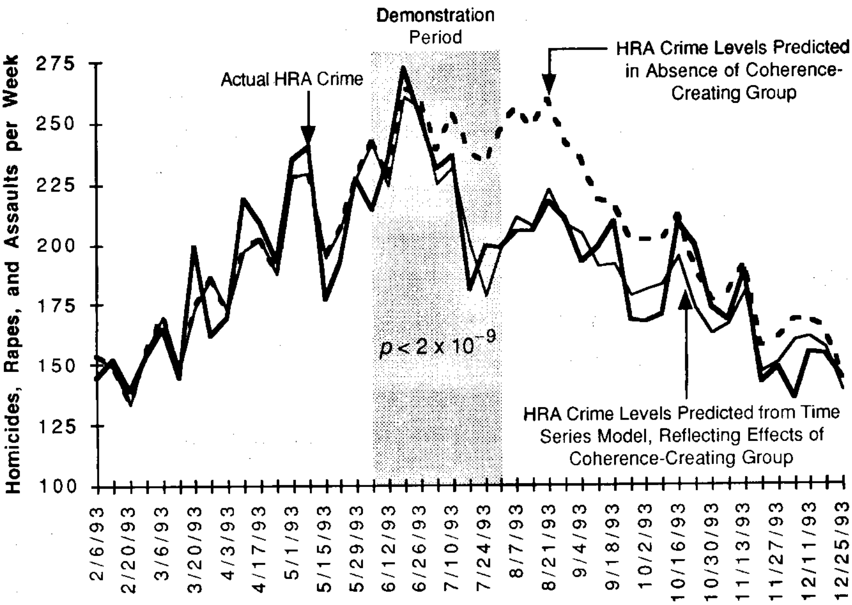

Figure 1. Effects of the National Demonstration Project on 1993 HRA crime levels in Washington, D.C. *Dark solid line* – actual HRA crime levels. *Light solid line* – predictions (or "fitted values") for HRA crime based on the time series model, reflecting effects of the coherence-creating group. *Dotted line* – HRA crime levels predicted to occur in the absence of the coherence-creating group. *Shaded area* – the period of the Demonstration Project.

Figure 1 also shows that as the size of the coherence-creating group increased, the level of HRA crimes decreased significantly, with the maximum decrease occurring during the last week of the Demonstration Project, when the group had reached its peak of approximately 4,000. During the last week, HRA crimes (both actual crime and the levels predicted from the model) decreased sharply below the levels predicted in the absence of the group.

To calculate crime levels in the absence of the coherence-creating group (dotted line), the crime reduction attributed to the group had to be removed from the predictions of the time series model. Through the intervention parameters ω and δ, the time series model estimates the weekly reduction in crime attributable to the group.[12] To remove the group's influence, this estimated weekly crime reduction was added back to the decreased crime levels predicted from the model (light solid line). This yielded levels of HRA crime that would have been predicted in the absence of the group. (The weekly

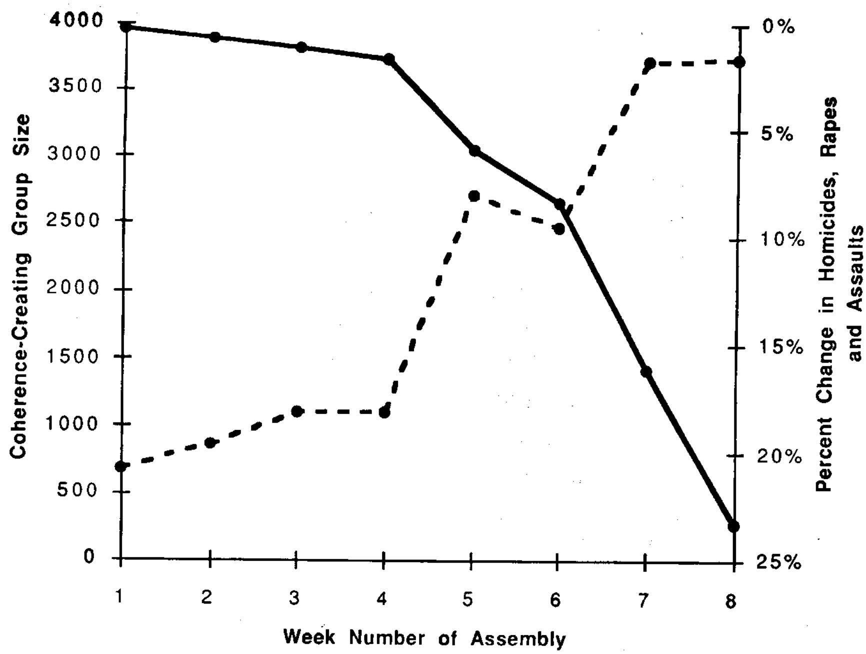

Figure 2. Percentage change in HRA crimes (*solid line*) in relation to the size of the coherence-creating group (*dotted line*) over the 8 weeks of the Demonstration Project.

crime reduction attributed to the group by the time series model is represented by the vertical distance between the dotted and light solid lines.)

Figure 2 shows the percentage reduction in HRA crimes during each week of the Demonstration Project in relation to the group size. This percentage was calculated by dividing the estimated weekly reduction in HRA crimes attributed to the group by the estimated levels of crime predicted in the absence of the group.

For example, during the last week of the Demonstration Project, there was an estimated decrease of 54.2 HRA crimes attributed to the group. Adding back this estimated decrease to the lower crime levels predicted from the model (178.4) yields a total of 232.6 HRA crimes predicted in the absence of the group.

Therefore, the estimated percentage decrease in HRA crimes during the last week of the Demonstration Project was 54.2 divided by 232.6, yielding a 23.3% decrease. Alternatively stated, relative to the lower crime levels that were achieved during the Demonstration Project, crime would have been 30.4% higher without the intervention.

An alternative method of calculating the estimated level of HRA crimes in the absence of the coherence-creating group is to add back the estimated weekly crime decrease to actual crime levels. For this purpose, actual HRA crime figures were averaged over two-week intervals, in order to reduce the effect of random fluctuations (the group size increased every two weeks but remained constant in between). This calculation yielded a maximum decrease of 22.2% in HRA crimes during the last week of the Demonstration Project. However, basing the calculation (as described earlier) on fitted (predicted) values from the model – instead of on actual crime levels – is likely to yield a more accurate estimate of the percentage decrease in crime, because this method minimizes the influence of random noise reflected in actual crime.

Since the results reported in Table I are derived from 1993 data, it is important to check whether the same results would be obtained using a substantially longer baseline. Therefore, a further analysis was performed based on weekly data from 1988–1993 (313 weeks). As in the time series analysis of 1993 data, this additional analysis found that the effect of the coherence-creating group was highly statistically significant (immediate effect, ω: $p < 0.00003$; decay parameter, δ: $p < 2 \times 10^{-53}$). The value of the decay parameter for the intervention, δ (0.90) was very similar to that obtained in the base model for 1993 data. However, the analysis of 1988–1993 data yielded a slightly larger decrease in HRA crimes; the maximum decrease was 24.6% during the final week of the Demonstration Project.

In this analysis, temperature was again highly significant as a control variable ($p < 6 \times 10^{-12}$). The best fitting time series model for this data set (based on minimizing the AIC) contained a moving average noise model term at lag 1 and an autoregressive term at lag 4, which were statistically significant ($p = 3 \times 10^{-79}$ and $p = 0.02$ respectively). There were no significant autocorrelations in the residuals up to lag 60 weeks, indicating that the model successfully accounted for any cycles and trends in HRA crimes – including annual seasonality and the influence of crime levels in the previous

TABLE II

Parameter estimates for temperature structural break model (1993 HRA crimes)

Parameter		Variable	Description	Lag	Estimate	t(39)	
1	C		Constant		67.0769	14.01	***
2	α_1	$TEMP_t$	Temperature	0	1.9607	26.23	***
3	α_2	$TEMPSHIFT_t$	Temperature[a]	0	−0.2026	−2.96	**
Intervention Parameters (Coherence-Creating Group Size):							
4	ω	S_t^2	Immediate impact[b]	0	−1.4367	−5.47	***
5	δ	S_t^2	Decay parameter[c]	1	0.7903	9.45	***
Noise Model Terms:							
6	ϕ_2	n_t	AR	2	−0.3148	−2.75	**
7	ϕ_3	n_t	AR	3	−0.2822	−2.37	*
8	ϕ_5	n_t	AR	5	−0.6258	−5.11	***

*$p < 0.01$; **$p < 0.001$; ***$p < 0.0001$ (Two-tailed for noise parameters).
[a]Structural break variable for temperature, equal to zero until the last week of the Demonstration Project, and equal to temperature in subsequent weeks.
[b]Numerator parameter of the transfer function for the intervention (where the group size squared was divided by 1 million to assist in convergence of iterative procedures for estimation of the model parameters).
[c]Denominator parameter
Ljung-Box test of joint significance of residual autocorrelations:
Lags 1–12, $\chi^2(9) = 9.4, p > 0.40$
$R^2 = 0.865$
Effective N = 47
Residual S.E. = 12.11
AIC = 250.466

year.[13] (Note that all subsequent analyses are based on 1993 HRA crime data only.)

At the end of the Demonstration Project, when the group size dropped to zero, crime remained low for several months before returning to predicted levels. This is reflected in the high value for the decay parameter found in the base model for 1993 HRA crimes, $\delta = 0.91$. Because some of the previous studies on coherence-creating groups have observed a somewhat faster decay of the intervention effect (e.g., Dillbeck, 1990; Dillbeck et al., 1988), further analysis investigated whether this apparent slow decay could be due to other factors – for example, a change in the relationship between crime and temperature during the year. In this supplementary analysis, reported in Table II, the time series model for 1993 HRA crimes was augmented to allow for a possible structural change in the relationship between HRA crimes and temperature during the middle of 1993.[14] This analysis indeed found that there was a such a structural change, which occurred near the end of the Demonstration Project: after the intervention, rises in temperature were associated with smaller increases in HRA crimes than seen before the intervention.

The results for this supplementary analysis showed that the structural break for temperature during 1993 was highly significant ($p = 0.005$), and also that all of the variables and noise terms in the base model for 1993 data (i.e., the time series model shown in Table I) remained highly significant. The supplementary analysis, based on the augmented model for 1993 data, yielded a smaller value for the decay parameter – 0.79, compared to 0.91 in the base model. This indicates a faster diminishing of the intervention effects at the end of the Demonstration Project. For example, 8 weeks after the final week of the Demonstration Project, the model for this supplementary analysis yields an estimated decrease in crime that is much less (15.2% of the decrease found in the final week) than that found in the base model (45.9%).[15] Nevertheless, the intervention effect again remained highly significant: $p < 2 \times 10^{-6}$ for the immediate effect of the intervention; $p < 7 \times 10^{-12}$ for the decay parameter. Using the modified model, the reduction in HRA crime levels (from the levels predicted without the Demonstration Project), estimated at 20.6% for the last week of the Demonstration Project, was similar to that obtained in the base model. (The same analysis, applied to 1992 data, showed that a similar structural break occurred at approximately the same time during the year.)

In the two models shown in Tables I and II, the intervention variable is the size of the total coherence-creating group squared, in accordance with published theory and past research on the effect of such groups practicing the Transcendental Meditation and TM-Sidhi programs (described above). A further check on the robustness of the findings was provided by also substituting as the intervention variable in the base model for 1993 HRA crimes (1) the unsquared group size, and (2) the sum of the squared number of participants across course locations. Significant reductions in crime were found regardless of the choice of intervention variable. The model using the total group size squared yielded the lowest AIC, indicating that this intervention variable has greater predictive power.

Because spurious correlations between two variables can arise from simultaneous, causally unrelated trends in each variable, it is important to investigate whether the significance of temperature in the 1993 models merely reflects causally unrelated upward trends in both temperature and HRA crimes during the period analyzed. This is unlikely because of the known relationship of temperature to HRA crimes over a five-year period, discussed previously, but the question can be addressed directly using differencing. A standard strategy suggested by Granger and Newbold (1974), which removes trends from all variables, is to difference all terms in the model: that is, all dependent and independent variables are differenced and then substituted in place of the original variables in the model. Although differencing was not required to achieve a stationary model, differencing was performed on the base model to check for such possible spurious relationships.

In the differenced model for 1993 data, temperature was still highly statistically significant ($p < 5 \times 10^{-24}$), as were the intervention parameters ($p < 2 \times 10^{-9}$ for the immediate effect of the intervention; $p < 10^{-31}$ for the decay parameter). This indicates that change in the intervention and control variables was significantly related to change in HRA crimes, thus ruling out the possibility of a spurious relationship between HRA crimes and temperature.[16] This also addresses the potential concern that the intervention variable was significant because the group size and HRA crimes were following causally unrelated trends during the Demonstration Project.

Since all the above analyses are based on aggregation of daily HRA crime data into weekly totals, a further analysis was performed on unaggregated daily HRA crime data for 1993, to see if this would yield consistent findings. This analysis of daily data yielded a highly statistically significant decrease in HRA crimes as the coherence-creating group size increased (immediate effect ω: $p < 0.0006$; decay parameter δ: $p < 2 \times 10^{-98}$). The maximum decrease in HRA crimes was 21.5% during the last week of the Demonstration Project, a finding similar to the estimate obtained from the analysis of weekly HRA crime data.[17]

It is also important to investigate whether the significance of the intervention could be explained by annually occurring factors (that is, whether spurious relationships might be caused by similar changes in HRA crimes that occur every year). If this were the case, then significance should still be obtained using the 1993 intervention data (for the coherence-creating group size) with data for HRA crimes and temperature for each year from 1988 to 1992 – as if the Demonstration Project had taken place in each of the preceding five years. However, when the base model was applied to 1988–1992 (with group size data for 1993), the results were not significant. This analysis follows the recommendation of Phillips (1986) that time series studies should take pains to present parallel analyses which, according to the theory being tested, should not yield significance except in the presence of spurious relationships.

Control for Changes in Police Activity and Community Anti-Crime Activity

Information on changes in police activity (increases in either overtime hours or number of personnel) during the Demonstration Project was obtained for each of the seven police districts in Washington, D.C., from Police Department personnel. Table III summarizes this information district by district. Only in Districts 1, 5–7 were there significant increases in police shifts that started during the Demonstration Project. Increases in Districts 2 and 3 began well before the project. To assess the effects of these staffing changes, the total number of additional person-shifts for all police districts was calculated for each week of 1993. This was entered as an additional control variable in the time series model.

The results of this additional supplementary analysis yielded very similar conclusions to those obtained using the base model. The effects of the Demonstration Project remained highly significant ($p < 2 \times 10^{-8}$ for the immediate effect; $p < 4 \times 10^{-42}$ for the decay parameter) and accounted for a 22.4% reduction in HRA

TABLE III

Reported changes in police activities

District	Month(s)	Days of week	Increase in personnel/ overtime hours	Routine summer activity	Normal deployment (patrol officers)
1	Jun 22–Jan 1994	Fri–Sun nights	+25–30 officers	yes	100–115 officers/day
2	May–Oct	Fri–Sun nights 8pm–4am	+20 officers	yes	approx 92–100 officers/day
3	Apr–Dec	Th–Sat night 6pm–2am	+20 officers	yes	approx 100 officers/day (30–35/shift)
4	Jun–July	Mon–Sun all shifts	No significant increase	yes	100–145 officers/day (25–70/shift)
5	Beg. of Jun–end of Aug	Mon–Sun 8am–4pm	20 officers shifted from schools to recreation areas	yes	180–185 officers/day (55–60/shift)
		4pm–midnight	+15 officers	yes	(80/shift)
		Th–Sat 4pm–midnight	+10–15 additional officers	yes	
6	Last wk Jun–end of Dec	Th–Sat night	+25 officers	no	approx 127 officers/day
7	Jul 1–Dec	Th–Sun night 6pm–2am	+60–70 officers per day, plus patrol hours shifted from other times	no	approx 135 officers/day

crimes. However, the analysis showed that police staffing changes did not have a significant effect on reducing HRA crime ($p = 0.32$, one-tailed).

Also, on July 13, 1993, the *Washington Post* reported that a coalition of religious and community leaders began a 72-hour moratorium on crime. However, a follow-up article in the *Post* dated July 16 reported that the "crime moratorium lacks patrols", and noted a very small turnout for the event. Of seven hundred city residents who had signed up for four-hour shifts to patrol high-crime areas, about 100 actually attended; and only a dozen of approximately 30 volunteers stationed at a site in District 5 at 8 p.m. were still present at 10:30 p.m. In any event, it is unlikely that a 72-hour moratorium could account for the declining crime trend throughout the two-month Demonstration Project.

Time Series Analysis of Homicides, Rapes, and Assaults as Separate Outcomes

An analysis was also conducted for each category of violent crime taken separately – homicides, rapes, and assaults. A separate time series analysis was performed for each variable using weekly 1993 data, with the same statistical procedure used in the analysis of HRA crimes taken together. The results of this analysis showed that temperature was a significant predictor for each of these variables. Rapes and assaults decreased significantly as the group size increased ($p < 0.005$ and $p < 10^{-12}$ respectively), with maximum estimated decreases of 58.1% for rapes and 19.0% for assaults occurring during the last week of the Demonstration Project. Homicides also decreased very slightly; however this reduction was not statistically significant.

Time Series Analyses of Effects on Robberies and on Total Violent Crime

Based on the stepwise regression analysis for the years 1988–1992 (see Method section), the time series model for 1993 robberies included a control variable for the annual seasonal pattern of robberies (robberies averaged weekly over 1988–1992). This variable was a significant predictor of weekly robberies in 1993. The coherence-creating group did not have a significant immediate impact ($p = 0.46$, one-tailed) on robberies, nor was there any evidence of a delayed effect.

However, although the intervention effect on robberies considered alone was not significant, joint estimation of the models for 1993 HRA crimes and robberies indicated that the model parameters for the coherence-creating group (i.e., immediate impact and delayed effect on HRA crimes, and immediate effect on robberies) were jointly significant ($p = 0.0008$).[18]

The reduction in total violent crime, relative to levels that would have been predicted in the absence of the coherence-creating group, was calculated by combining the estimated reductions in HRA crimes and robberies from the two separate models.[19] This indicated that the maximum decrease occurred during the last week of the Demonstration Project, and was 15.6%.

DISCUSSION

The results of time series analysis of weekly data are consistent with the prediction that levels of violent crime would fall significantly during the period of the Demonstration Project, when a large group of practitioners of the Transcendental Meditation and TM-Sidhi programs assembled in Washington, D.C. This effect was hypothesized to occur through the propagation of coherence and orderliness in the field of collective consciousness, leading to reduced social stress and violent crime. During the assembly, there was a highly significant reduction in HRA crimes (homicides, rapes, and assaults) below predicted levels. As shown in Figure 2, it was found that HRA crime levels fell as the size of the group increased. By the eighth week of the Demonstration Project, when the group was largest, crime had decreased by an estimated 23.3%. Although the overall crime reduction for the entire eight weeks was less, this may reflect that the group was smaller during the earlier weeks. To assess the impact of the Demonstration Project it is therefore important to examine whether there was any "dose-response", or association between varying levels participation in the coherence-creating group and the outcome variable. During the Demonstration Project the correlation between the size of the group squared and HRA crime levels was – 0.76 (which translates into a Glass effect size of –2.3 standard deviation units), suggesting a strong effect of the coherence-creating group. A correlation of 0.5 or above (in absolute value) or an effect size of 0.8 or larger is considered to indicate a strong statistical effect (Cohen, 1988).

The time series analysis methodology employed in the study is a most rigorous approach for evaluating the effects of the Demonstration Project, because it explicitly controls for a wide range of factors that influence the dependent variable, including the past history of violent crime, recent crime trends, and annual seasonal crime patterns. Moreover, the analysis controls not only for endogenous cycles and trends in the crime data itself, but also for other extrinsic (exogenous) variables known to influence crime. Further, any exogenous influences that are not explicitly incorporated into the time series model tend to be reflected in the noise model, and are thus implicitly controlled for (Box and Jenkins, 1976; Vandaele, 1983). Only after controlling for these factors was the intervention deemed to have a significant effect. Thus the analysis comprehensively addresses the most plausible alternative explanations for the observed decrease in HRA crimes.

The statistical analysis considered the potential confounding effects of weather variables, daylight hours, and changes in police staffing. Among these, the only exogenous variable that was found to predict crime levels was temperature, which was explicitly controlled for in the analysis. To be very conservative, however, a further time series analysis was performed to investigate the effect of additional police staffing on HRA crime levels. Although this analysis found that police staffing produced a small effect on reducing crime, this reduction was not found to be statistically significant. However, this analysis yielded similar highly significant results for the coherence-creating group to those found using the base model.

The possibility that the period of the Demonstration Project happened to coincide with an annual drop in HRA crime levels during the summer was also excluded; time series analysis of the same months as the intervention during each of the five previous years showed that HRA crimes did not decrease significantly. Also, monthly crime totals in Washington (adjusted for seasonal patterns) were uncorrelated with those in Philadelphia and New York over the past five years, and so it is very unlikely that some pervasive influence in the eastern region of the U.S. was responsible for the crime drop in Washington during the Demonstration Project. Furthermore, results are not dependent on choice of sample period: significant reductions in HRA crimes were also observed in Washington, D.C. during the Demonstration Project, with a longer baseline before the intervention, performing time series analysis of HRA crime data for 1988–1993.

All the time series analyses of HRA crimes explicitly controlled for annual seasonal patterns of crime through modeling the effects of annual temperature cycles. Moreover, the analysis with a longer baseline in addition explicitly controlled for annual seasonality through the noise model, thus specifically addressing patterns of crime in the summer. The inclusion of temperature in all the models was strongly justified by the considerable body of research (e.g., Harries, 1990; Castaneda, 1991; Michael and Zumpe, 1983; Cotton, 1986; Cheatwood, 1995) showing correlations between temperature and homicides, rapes, and assaults; because it was specified a priori as a control variable in the research protocol; and because the regression analysis of data from the past five years established the existence of a relationship between temperature and HRA crimes for prior years in Washington, D.C. The validity of including temperature was confirmed by the fact that it was highly significant in the models. Temperature and previous crime trends predicted HRA crimes quite well until the period of the Demonstration Project. However, during the Demonstration Project, as the coherence-creating group size increased, HRA crimes fell below the levels that would have been predicted in the group's absence based on this prior relationship with temperature.

Given that violent crime usually increases during June and July, and that temperatures during parts of the Demonstration Project were at record highs (with 32 out of the 54 days during the Demonstration over 90 °F, compared with only 14 days over 90 °F during the same period in 1992), the significant reductions in HRA crime levels are particularly noteworthy. Even a crude comparison of crime levels in July (the hottest month) with those in May and June is consistent with the results of the more sophisticated approach of time series analysis. During the five previous years, average levels of HRA crime in July were higher than the average over May and

June. However, in July 1993, when the number of participants in the Demonstration Project was largest, HRA crime levels were lower than the May-June average for that year, despite higher temperature. This decrease in crime from the high levels before the Demonstration Project was not merely regression towards the mean (i.e., a return towards predicted levels[20]), because crime fell well below the levels that would have been predicted in the absence of the group (compare the solid lines with the dotted line in Figure 1), and continued decreasing after that point.

It is unlikely that the results are an artifact of the choice of time series model. Since model selection procedures were objectively based on minimizing the Akaike Information Criterion (AIC) (Larimore, 1983), model selection was largely dictated by the data itself. Moreover, significant effects of the coherence-creating group were obtained under a wide variety of alternative assumptions that were used to construct a number of different models. Results were significant when different noise models were used; when the independent variable was specified in different ways; when the base model was differenced to exclude the possibility of contemporaneous trends; when allowance was made for a structural break; when all control variables were omitted; when different baseline lengths were used; and when daily (instead of weekly) data was analyzed. Regardless of these alternative models, the influence of the coherence-creating group size proved to be highly robust.

That robberies are less strongly related to social stress than are HRA crimes (Linsky and Straus, 1986)[21] may partially explain why there was not a significant reduction in robberies during the Demonstration Project. Also, robberies may be less responsive to immediate decreases in stress in collective consciousness because they are often related to long-established drug abuse habits and involve a degree of prior planning (Sommers and Baskin, 1993). Therefore, we hypothesize that a longer intervention period may be required to reduce them. Previous research on the Maharishi Effect has demonstrated decreases in total crime, and total violent crime, but has not focused specifically on reductions in robberies (for a review, see Orme-Johnson, 1994).

Whereas assaults and rapes declined significantly as the size of the coherence-creating group increased, homicides decreased only slightly. Given the low base rate of homicides (less than 3% of total violent crimes), statistical power analysis (Cohen, 1988) indicates that, in order for any decrease in homicides during the Demonstration Project to be reliably detected as statistically significant, the average reduction in homicides during July (when the coherence-creating group was largest) would need to have been at least 40%; thus the effect of the Demonstration Project on homicides would need to have been substantially greater than the effect on HRA crimes as a whole. Although rapes also had a low frequency of occurrence (2%), the reduction in rapes during the Demonstration Project was so large (58%) that it was nevertheless statistically significant. An earlier study (Lanford, 1990) showed that a coherence-creating group did significantly reduce homicides in Washington, D.C. when maintained over a three-year period. Although homicides decreased only slightly during the Demonstration Project, this suggests that maintaining the large coherence-creating group over a longer time period might also have been necessary to reduce homicides. Assaults and rapes are serious crimes against the person, which can easily escalate into homicides. Therefore, reduction in these events suggests a potentially preventive effect on homicides over the long term if the group were maintained.

The base model for HRA crimes yielded a value for the decay parameter δ (0.91) implying a very gradual build-up and gradual decay of the intervention effects – somewhat slower, in fact, than that reported in some previous studies (e.g., Dillbeck, 1990; Dillbeck et al., 1988). A supplementary analysis was performed to assess whether the slow decay could have been due to other factors. This analysis found that there was a change in the relationship between crime and temperature at the end of the Demonstration Project, which yielded a faster decay in the intervention effects (δ = 0.79). Also, although this supplementary analysis of the structural break model for temperature during 1993 found a much faster decay of the intervention effects compared to the base model (see Table I), both models yielded similar findings for the significance of the intervention and the percentage reduction in crime. Thus the results are not dependent on the slow decay of the intervention effects.

The presence of a statistically significant decay parameter in either model indicates that the Demonstration Project had an appreciable effect for some weeks after its ending date. Furthermore, because the decay parameter in the time series model predicts that the effect of the group persists and accumulates over time, it suggests that crime would have decreased even further if the group had continued over the long term, with crime patterns eventually settling to a steady state at a reduced rate. Time series analysis has the valuable feature of allowing extrapolation from the effects of a short-term intervention to assess the effects of one that continues over a longer period. In the current study, the model parameters can be used to extrapolate from the results of the 8-week Demonstration Project to predict long-term reductions in crime had a coherence-creating group of 4,000 remained in Washington indefinitely.

Because of the faster decay rate for the intervention found in the supplementary (structural break) analysis (Table II), this model yields a more conservative estimate of the long-range effects. The long-term crime reduction was calculated using the formula for the steady state gain, given by $g = [\omega/(1 - \delta)](4{,}000)^2$ (where ω and δ are as in Table II, and 4,000 is the assumed steady state level for the coherence-creating group size: Box and Jenkins, 1976: p. 346). Based on this formula, it is estimated that 109.6 HRA crimes per week would be averted, representing a 48% reduction relative to the actual number during the week immediately preceding the Demonstration Project.

Previous evidence is consistent with the cumulative effects of coherence-creating groups over time. For example, FBI statistics show that during the early 1980s, when a much smaller group of approximately 400 was continuously in Washington, D.C., violent crime decreased by an average of 8% per year for more than four years, for a cumulative reduction of 35% (Federal Bureau of Investigation, 1982–1987).

Note that because the models predict not only an immediate effect in response to changes in the group size, but also a cumulative effect, it implies that the full effect of the Demonstration Project lagged behind changes in group size. This "lead-lag" relationship, consistent with a causal interpretation, has also been found in many previous studies on coherence-creating groups (e.g., Orme-Johnson et al., 1988; Dillbeck, 1990).

To further address the issue of causality, the reverse theoretical prediction was also examined: that changes in crime levels could have caused changes in group size, rather than the opposite. This was tested empirically by examining the cross correlation between white noise residuals from the base model of HRA crimes (omitting the intervention) and values of the group size squared which were filtered using the time series model for HRA crimes. This "prewhitening" technique (Box and Jenkins, 1976) reveals how fluctuations in a putative causal variable affect the other variable, while removing endogenous dynamics and any other time-dependent structure that may confound causal interpretation. In the present data, the cross correlations between changes in crime level and subsequent changes in the group size were not significant up to a lag of 10 weeks (which was longer than the intervention period). In other words, there was no evidence that changes in crime levels caused changes in the group size. This argues against the possibility that early reports of crime reduction through the Demonstration Project significantly accelerated levels of participation in the coherence-creating group. Moreover, based on time series analysis (reported above) of the same period as the Demonstration Project during the previous five years, there was no historical pattern of crime reduction in the summer months; thus the Demonstration Project was not scheduled at a time when crime was expected to decrease.

It seems unlikely that a third variable can account for the correlation between the group size and HRA crimes. The possibility of common trends underlying both variables was addressed by differencing (which, as previously noted, removed trends from each variable in the model). Also, exogenous factors (e.g., temperature) that are known to influence crime were explicitly controlled for. An unknown underlying third variable would need to influence crime in the District of Columbia, in the same stepwise manner that the group increased, specifically during the summer of 1993, and also to influence changes in the group size over the same time period. Moreover, it should also have applied during the same period in previous years.

The most powerful argument for causality is repeated replication of effects. Effects of coherence-creating groups on a broad spectrum of variables have been investigated by 41 previous studies, nearly half of which have been reported in peer-reviewed journals. In many cases, results have been predicted publicly in advance, and the data used has been collected independently by governmental and other institutions, and is publicly available (e.g., Dillbeck et al., 1987; Dillbeck, 1990). Moreover, several of these studies continued for months or years, during which time the attendance at the assemblies fluctuated over relatively wide ranges (e.g., Orme-Johnson et al., 1988; Dillbeck, 1990). In these studies, time series analysis has demonstrated that the fluctuations in attendance correlate significantly with the fluctuations in crime, accidents, warfare and other dependent variables being studied; that is, each of these studies has itself contained a number of replications of the effect. The cumulative probability that all of these findings could occur by chance is extremely small. Moreover, in the many years of academic discussion of this phenomenon at conferences and in journal articles, no plausible third variable has ever been proposed that could account for these consistent findings across such diverse conditions.

Although a more conventional mechanism than field effects of consciousness might explain these results, no such alternative explanation has been proposed. In the Demonstration Project, as in many previous studies, there was virtually no behavioral interaction between the members of the coherence-creating group and the population deemed to be affected. Participants took part in special in-residence programs involving minimal contact with the community, and the group was very small in comparison to the larger, target population (which in some of the regional and national studies was at an even greater distance from the group).[22]

Consistent with the theory that field effects generated by coherence-creating groups reduce stress in collective consciousness, the predictions for the Demonstration Project lodged in advance with the independent Project Review Board and the news media also included increased success and support for the U.S. President and improvement on an index of quality-of-life variables in Washington, D.C. In a separate study using time series analysis, Goodman (1997) found that all seven of the following available sociological variables showed significant positive impact of the coherence-creating group after the start of the Demonstration Project, in contrast to a trend of growing negativity prior to the Project. Measures included (1) Presidential approval ratings; (2) media positivity towards the President; (3) four variables indicative of social stress in Washington, D.C.: emergency psychiatric calls, hospital emergency room trauma cases, complaints against the police, and accidental deaths; and (4) a social stress (or "quality-of-life") index comprising the previous four social stress variables.

Goodman's results, as well as prior multidimensional studies of this effect, have shown that a number of disparate variables change in a positive direction. Given the absence of an alternative explanation; that there was no direct behavioral interaction of the people in the group with the target population; occurrence of effects at a distance; and a wide range of separate parameters influenced simultaneously across a whole population – the most parsimonious explanation is that an underlying field effect of reduced societal stress and increased coherence in collective consciousness produced positive changes in all these areas. That a small intervention in relation to the target population (i.e., a "minimal manipulation" of the independent variable: Prentice and Miller, 1992) had detectable effects on multiple outcome measures is evidence of a theoretically important relationship between collective consciousness and societal quality of life.

The results of the 42 studies on the Maharishi Effect have repeatedly supported the hypothesis that violent crime and other measures of social disorder can be reduced through coherence-creating groups. This latest study was designed as a Demonstration Project – not only to provide another opportunity to investigate the hypothesis, but also to bring public and governmental attention to this phenomenon. Given the devastating financial and human costs of violent crime, and the lack of other scientifically validated, cost-effective means to reduce it, these repeated, highly encouraging results warrant serious consideration by scientists and policy makers. Priority should be given to large-scale practical application of this approach, which already has strong empirical support, and which appears to offer an opportunity for the solution and prevention of major problems in our society.

NOTES

[1] Transcendental Meditation, TM, TM-Sidhi, Consciousness-Based and Maharishi Vedic Science and Technology are registered or common law trademarks licenced to Maharishi Vedic Education Corporation and used under sublicense or with permission.

[2] Dillbeck et al. (1987) discuss in detail Maharishi's consciousness-based approach to creating coherence in the collective consciousness of society in relation to modern psychological and sociological theories of consciousness.

[3] Hagelin (1998) gives a more detailed theoretical discussion of the correspondences between Maharishi's description of consciousness and quantum field theory, and the implications for alleviating crime and other social problems and improving the quality of life in society.

[4] The proposal of a threshold effect whereby orderly trends in society would be enhanced only after the influence to reduce social stress surpasses a threshold is consistent with the literature on social stress. Straus (1980) found a relationship between life events stress and physical aggression towards spouses when the stress level exceeded one standard deviation above the mean, but not below this threshold. If societal stress were reduced below this threshold, stress would be less likely to give rise to violence.

[5] For example, Dillbeck et al. (1987) reported reduced violent crime corresponding with coherence-creating groups in Manila, Philippines; Union Territory of Delhi (national capital region); Puerto Rico; and Rhode Island. In England, Hatchard et al. (1996) found a significant decrease in crime in the Merseyside metropolitan region corresponding with increasing size of a long-term coherence-creating group in the vicinity. In the U.S., a 4-year study found that when attendance in a large coherence-creating group at Maharishi University of Management in Iowa increased, violent deaths (homicides, suicides, and traffic accidents) significantly declined in the nation as a whole (Dillbeck, 1990). A formal prospective experiment involving a two-month coherence-creating assembly in Israel (Orme-Johnson et al., 1988) found that on days of high participation in the group, armed conflict in neighboring Lebanon decreased significantly and composite quality-of-life indices, including crime, significantly improved in Jerusalem and in Israel as a whole. A follow-up study over a two-and-one-quarter-year period found that, during seven coherence-creating assemblies theoretically large enough to influence the Lebanese conflict, armed conflict in Lebanon decreased significantly compared to control periods (Davies and Alexander, 1989).

[6] The TM-Sidhi program was practiced from 7:30 a.m. till noon, and again in the late afternoon, from 5:00 p.m. until 7:00 p.m. A detailed list of the housing locations is available from the Institute of Science, Technology and Public Policy, Maharishi University of Management, Fairfield, Iowa 52557, USA.

[7] A review of the literature on crime shows that most factors which are known to influence crime are demographic variables that vary only slowly, over periods of years rather than weeks (such as age composition of the population and income

distribution), and therefore would not be relevant control variables in the present study. Therefore, these variables were not examined.

8 Daily data was also analyzed; this analysis is reported in the Results section.

9 In the time series model of 1988–1992 HRA crime data, all time dependent structure is accounted for by differencing all variables to remove trends and by including a moving average (lag 1) term in the "noise model" of the series.

10 The structural break test for the change in relationship between temperature and crime was performed by including an additional independent variable in the regression model of 1988–1993 data (cf. Johnston, 1984). This variable was equal to zero until the beginning of 1993, when it was equal to temperature. Since temperature was also an independent variable in the regression model, the significance of this additional variable indicates that the same temperature level predicted a higher number of crimes after the beginning of 1993.

11 Backshift notation is used to lag, or shift, a time series variable back an appropriate number of periods (in this case, a number of weeks) to allow for the influence of past values of the series on current values of the dependent variable.

12 The time series model yields an estimated weekly HRA crime reduction due to the coherence-creating group, which is based on the estimates of the immediate effect (ω) and the rate of build-up and gradual decay (δ) of the intervention (see Table I). The formula for the reduction in crime levels during week t is: $\omega \sum_{k \leq t} \delta^{t-k} S_k{}^2$. This expression is derived by taking the partial sum of the series expansion of the transfer function for the intervention: $\omega/(1 - \delta B)S_t{}^2 = \omega(1 + \delta B + \delta^2 B^2 + \delta^3 B^3 + \ldots)S_t{}^2$. When all the terms in the series are summed, the expression yields the formula for the steady state gain (Box and Jenkins, 1976: p. 346), indicating the effect of a permanent group of size S: $\omega/(1 - \delta)S^2$ (see Discussion section).

13 To remove the strong upward trend in HRA crime levels during the period as a whole, and thus achieve a stationary model, all variables in the model were differenced (by subtracting the previous time point from the current time point). To accurately model HRA crimes from 1988–1993, it was also necessary for this model to account for the aforementioned structural change in the relationship between HRA crimes and temperature in 1993 compared to the preceding 5 years (see Method section). The structural break was accounted for in the time series model by incorporating two additional variables (TEMP93 and LEVEL93), which respectively allowed for a change at the beginning of 1993 in the coefficient of temperature predicting HRA crime levels, and in the mean level of HRA crime. The structural break variables were highly significant ($p < 5 \times 10^{-7}$ and $p < 0.0003$ respectively) in this analysis. However, statistically significant results for the coherence-creating group were obtained even without modeling the structural break at the beginning of 1993 (immediate effect of the group, ω: $p = 0.011$; decay parameter, δ: $p < 3 \times 10^{-9}$). The equation for the model yielding the lowest AIC with 1988–1993 data was: $(1 - B)HRA_t = C + \alpha_1(1 - B)TEMP_t + \alpha_2(1 - B)TEMP93_t + C_2(1 - B)LEVEL93_t + \omega(1 - B)/(1 - \delta B)S_t{}^2 + (1 - \theta_1 B)/(1 - \phi_4 B^4)n_t$. The TEMP93 and LEVEL93 variables are equal to zero prior to the structural break at the beginning of 1993 and are respectively equal to TEMP (the

temperature variable) and 1.0 in subsequent weeks. The change in the coefficient of temperature is the result of regrouping the temperature terms in the equation: a 1-degree rise in temperature predicts α_1 additional HRA crimes before the structural break, but $\alpha_1 + \alpha_2$ additional HRA crimes in subsequent weeks. This enables a rise in temperature to predict a greater increase in the number of HRA crimes from the beginning of 1993 onwards. The significance of the TEMP93 and LEVEL93 variables confirms the existence of the structural break (Johnston, 1984). While statistically significant results for the coherence-creating group were found for 1988–1993 data regardless of whether or not the structural break was modeled, a smaller AIC value was obtained from the time series model including the structural break variables, showing that this model provided a better fit for the data.

14 The augmented time series model for 1993 HRA crimes (see Table II) which yielded the lowest AIC was given by the equation: $HRA_t = C + \alpha_1 TEMP_t + \alpha_2 TEMPSHIFT_t + \omega/(1 - \delta B)S_t^2 + 1/(1 - \phi_2 B^2 - \phi_3 B^3 - \phi_5 B^5)n_t$. (Note that this model investigated the structural break in the middle of 1993, whereas the analysis of 1988–1993 HRA crimes modeled a structural break at the beginning of 1993 compared to the previous year – see note 12.) The TEMPSHIFT variable, which models the structural break, plays a similar role to the TEMP93 variable in the analysis of 1988–1993 data (see note 12); it is equal to zero prior to the structural break and equal to TEMP (the temperature variable) in subsequent weeks. TEMPSHIFT enables a rise in temperature to predict either a smaller or greater increase in the number of HRA crimes from the break point onwards. (A level shift variable, analogous to LEVEL93 in the 1988–1993 analysis, was also entered in the model to see if there was a change in the constant term; however this variable was not significant and was subsequently omitted.) A smaller AIC value was obtained than for the base model for 1993 HRA crimes, showing that the augmented model provided a better fit to the data. Various time points for the structural break were considered. The AIC was minimized by modeling the structural break at the end of the Demonstration Project. As in the base model, all the standard diagnostic tests were satisfied by the augmented time series model.

15 This result was found because the after-effects of the intervention are accounted for by the higher temperature coefficient and the decay parameter together, rather than by a slow decay alone, as in the base model.

16 Because the residuals of the original models were white noise, the differenced model required an MA1 parameter equal to 1.0, indicating that the model had been over-differenced. This is considered a minor technicality in the context of this diagnostic procedure (Plosser and Schwert, 1978). However, because of this clear evidence of over-differencing, the differenced models were not used in the main analysis.

17 As in the weekly analysis, temperature (i.e., maximum daily temperature) was a significantly predictor of daily HRA crimes during 1993 ($p = 5 \times 10^{-22}$) and was therefore controlled for in the time series model. Daily precipitation and the average rate of HRA crimes for each day of the week during the preceding 5 years were also significant predictors ($p = 0.006$ and $p < 0.00006$ respectively) and

were also controlled for in the analysis. The best fitting time series model (based on minimizing the AIC) contained a moving average term at lag 7 days, which (along with the day-of-the-week variable) modeled the weekly crime cycle in the daily data. The diminishing of the intervention effect was modeled by a decay parameter at lag 7 days (by using a denominator term δ of lag 7 in the transfer function for the intervention). The lag 7 term was used to facilitate comparison with the weekly analysis, and also to facilitate convergence of the numerical estimation procedure for the model parameters. The value of the decay parameter (0.92) was very similar to that obtained in the base model for the weekly analysis. The equation for the best model for the daily HRA crime data in 1993 was: $HRA_t = C + \alpha\ TEMP_t + \beta\ PRECIP_t + \gamma\ WEEKLY_t + \omega/(1 - \delta B^7)S_t^2 + (1 - \theta_7 B^7)n_t$.

[18] As noted earlier, combining HRA crimes and robberies into a single index (as opposed to jointly estimating the two separate models) tends to blur the different seasonal patterns of the two components of violent crime, and hence attenuates the estimated intervention effect.

[19] This calculation was performed analogously to that for the estimated reduction in HRA crimes, reported above: i.e., the estimated decreases in HRA crimes and robberies were added back to the fitted (predicted) values for HRA crimes and robberies from the time series models.

[20] Regression towards the mean in this context refers to the fact that HRA crime levels would be expected to fall when they are above the conditional mean (or expected value) of the series predicted on the basis of temperature levels, and conversely would be expected to rise when they are below the conditional mean. Before the Demonstration Project, HRA crime levels were much higher than the conditional mean (indicated by the dotted line in Figure 1) and therefore might have been expected to decrease. However, during the Demonstration Project the decrease was larger than could be explained by regression effects alone, because HRA crime levels continued to decrease even after they had fallen well below the conditional mean.

[21] On their State Stress Index, the correlation between robberies and social stress was 0.45, compared with 0.68–0.72 for homicides, rapes, and aggravated assaults. When these correlations are expressed as Glass effect sizes to remove the ceiling of 1.0 on the strength of the relationship, the magnitude of the relationship of social stress with HRA crimes is twice that with robberies.

[22] For example in the present study, the maximum group size was approximately 4,000 whereas the 1993 population of the District of Columbia was 578,000.

REFERENCES

Abrams, A. I. and L. M. Siegel: 1978, 'The Transcendental Meditation program and rehabilitation at Folsom State Prison: A cross-validation study', Criminal Justice and Behavior 5(1), pp. 3–20.

Alexander, C. N., M. V. Rainforth and P. Gelderloos: 1991, 'Transcendental Meditation, self-actualization, and psychological health: A conceptual overview

and statistical meta-analysis', Journal of Social Behavior and Personality 6(5), pp. 189–247.
Alexander, C. N., P. Robinson, D. W. Orme-Johnson, R. H. Schneider and K. G. Walton: 1994, 'The effects of Transcendental Meditation compared to other methods of relaxation and meditation in reducing risk factors, morbidity, and mortality', Homeostasis 35, pp. 243–263.
Alexander, C. N., P. Robinson and M. V. Rainforth: 1994, 'Treating and preventing alcohol, nicotine, and drug abuse through Transcendental Meditation: A review and statistical meta-analysis', Alcoholism Treatment Quarterly 11, pp. 219–236.
Alexander, C. N., K. G. Walton, E. Marks and D. McLeland: in press, 'Multidimensional assessment of personality development in maximum security prisoners practicing the Transcendental Meditation Program (Part I)', Journal of Offender Rehabilitation.
American Psychological Association: 1993, Violence and Youth: Psychology's Response, Volume 1. Summary report of the Commission on Violence and Youth (American Psychological Association, Washington, DC).
Attar, B. K., N. G. Guerra and P. H. Tolan: 1994, 'Neighborhood disadvantage, stressful life events, and adjustment in urban elementary-school children', Special Issue: Impact of poverty on children, youth, and families, Journal of Clinical Child Psychology 23(4), pp. 391–400.
Bleick, C. R. and A. I. Abrams: 1987, 'The Transcendental Meditation program and criminal recidivism in California', Journal of Criminal Justice 15, pp. 211–230.
Box, G. E. P. and G. M. Jenkins: 1976, Time Series Analysis: Forecasting and Control (Holden-Day, San Francisco).
Brenner, M. H.: 1976, 'The impact of social and industrial changes on psychopathology: A view of stress from the standpoint of macrosocial trends', in L. Levi (ed.), Society, Stress, and Disease (Oxford University Press, Oxford).
Brenner, M. H.: 1980, 'The influence of economic stress on criminal aggression', in M. Molotof (ed.), Colloquium on Stress and Crime, Volume 2 (The Mitre Corporation, Bedford, MA), pp. 143–146.
Brooks, J. S. and T. Scarano: 1985, 'Transcendental Meditation in the treatment of post-Vietnam adjustment', Journal of Counseling and Development 64, pp. 212–215.
Bureau of Justice Statistics: 1988, The Seasonality of Crime Victimization (No. NCJ-111033) (Office of Justice Programs, U.S. Department of Justice, Washington, DC).
Bureau of Justice Statistics: 1997, Changes in Criminal Victimization, National Crime Victimization Survey, 1994–95 (No. NCJ-162032) (Office of Justice Programs, U.S. Department of Justice, Washington, DC).
Castaneda, R.: 1991, 'Winterkill and Washington', Washington Post (December 5), p. C5.
Chalmers, R. A., G. Clements, H. Schenkluhn and M. Weinless: 1989a, 1989b, 1990, Scientific Research on Maharishi's Transcendental Meditation and TM-

Sidhi Program: Collected Papers, Volumes 2–4 (Maharishi Vedic University Press, Vlodrop, Netherlands).
Cheatwood, D.: 1995, 'The effects of weather on homicide', Journal of Quantitative Criminology 11(1), pp. 51–70.
Cohen, J.: 1988, Statistical Power Analysis for the Behavioral Sciences (Lawrence Erlbaum Associates, Hillsdale, NJ).
Cotton, J. L.: 1986, 'Ambient temperature and violent crime', Journal of Applied Social Psychology 16, pp. 786–801.
Cranson, R. W., D. W. Orme-Johnson, J. Gackenbach, M. C. Dillbeck, C. H. Jones and C. N. Alexander: 1991, 'Transcendental Meditation and improved performance on intelligence related measures: A longitudinal study', Personality and Individual Differences 12, pp. 1105–1116.
Davies, J. L. and C. N. Alexander: 1989, 'Alleviating political violence through enhancing coherence in collective consciousness', paper presented at the 85th Annual Meeting of the American Political Science Association (September). (Refer also to Dissertation Abstracts International, 49(8), 2381A, 1988.)
Dillbeck, M. C.: 1990, 'Test of a field theory of consciousness and social change: Time series analysis of participation in the TM-Sidhi program and reduction of violent death in the U.S.', Social Indicators Research 22, pp. 399–418.
Dillbeck, M. C. and A. I. Abrams: 1987, 'The application of the Transcendental Meditation program to corrections', International Journal of Comparative and Applied Criminal Justice 11(1), pp. 111–132.
Dillbeck, M. C., C. B. Banus, C. Polanzi and G. S. Landrith III: 1988, 'Test of a field model of consciousness and social change: The Transcendental Meditation and TM-Sidhi program and decreased urban crime', The Journal of Mind and Behavior 9(4), pp. 457–486.
Dillbeck, M. C. and E. C. Bronson: 1981, 'Short-term longitudinal effects of the Transcendental Meditation technique on EEG power and coherence', International Journal of Neuroscience 14, pp. 147–151.
Dillbeck, M. C., K. L. Cavanaugh, T. Glenn, D. W. Orme-Johnson and V. Mittlefehldt: 1987, 'Consciousness as a field: The Transcendental Meditation and TM-Sidhi program and changes in social indicators', The Journal of Mind and Behavior 8(1), pp. 67–104.
Dillbeck, M. C., G. S. Landrith III and D. W. Orme-Johnson: 1981, 'The Transcendental Meditation program and crime rate change in a sample of forty-eight cities', Journal of Crime and Justice 4, pp. 25–45.
Dillbeck, M. C., H. I. Msemaje, B. M. Clayborne and S. L. Dillbeck: 1990, 'Effects of the Transcendental Meditation program with low income inner city children', paper presented at the 98th Annual Convention of the American Psychological Association, Boston, MA (August).
Dillbeck, M. C. and D. W. Orme-Johnson: 1987, 'Physiological differences between Transcendental Meditation and rest', American Psychologist 42, pp. 879–881.
Dillbeck, M. C. and M. V. Rainforth: 1996, 'Impact assessment analysis of behavioral quality of life indices: Effects of group practice of the Transcendental

Meditation and TM-Sidhi program', 1996 Proceedings of the Social Statistics Section, American Statistical Association (American Statistical Association, Alexandria, VA), pp. 38–43.

District of Columbia Government: 1996, Crime and Justice Trends in the District of Columbia (Office of Grants Management and Development, Washington, DC).

Eppley, K., A. Abrams and J. Shear: 1989, 'The differential effects of relaxation techniques on trait anxiety: A meta-analysis', Journal of Clinical Psychology 45(6), pp. 957–974.

Federal Bureau of Investigation: 1982–1987, 1993–1996, Crime in the United States, 1981, 1982, 1983, 1984, 1985, 1986, 1992, 1993, 1994, 1995: Uniform Crime Reports (U.S. Department of Justice, Washington, DC).

Ferris, C. F. and T. Grisso (eds.): 1996, 'Understanding Aggressive Behavior in Children', Annals of the New York Academy of Sciences, Volume 794 (The New York Academy of Sciences, New York).

Gelderloos, P. and W. P. van den Berg, 1989: 'Maharishi's TM-Sidhi program: Participating in the infinite creativity of nature to enliven the totality of the cosmic psyche in all aspects of life', Modern Science and Vedic Science 2, pp. 373–412.

Gest, T.: 1994, 'Cost of crime: $674 billion', U.S. News and World Report (Jan. 17), pp. 40–41.

Goodman, R. S.: 1997, The Maharishi Effect and government: Effects of a national demonstration project and a permanent group of Transcendental Meditation and TM-Sidhi program practitioners on success, public approval, and coherence in the Clinton, Reagan, and Bush presidencies (doctoral dissertation) (Maharishi University of Management, Fairfield, IA).

Granger, C. W. J.: 1990, 'Aggregation of time series variables: A survey', in T. Barker and M. H. Pesaran (eds.), Econometric Modelling (Routledge, London), pp. 17–34.

Granger, C. W. J. and P. Newbold: 1974, 'Spurious regressions in econometrics', Econometrics 2, pp. 111–120.

Granger, C. W. J. and P. Newbold: 1977, Forecasting Economic Time Series (Academic Press, New York).

Greenwood, P. W., C. P. Rydell, A. F. Abrahamse, J. P. Caulkins, J. Chiesa, K. E. Model and S. P. Klein: 1994, Three Strikes and You're Out: Estimated Benefits and Costs of California's New Mandatory-Sentencing Law (RAND, Santa Monica, CA).

Hagelin, J. S.: 1987, 'Is consciousness the unified field? A field theorist's perspective', Modern Science and Vedic Science 1, pp. 28–87.

Hagelin, J. S.: 1998, Manual for a Perfect Government (Maharishi University of Management Press, Fairfield, IA).

Hagelin, J. S., D. W. Orme-Johnson, M. V. Rainforth, K. Cavanaugh and C. N. Alexander: 1994, 'Results of the national demonstration project to reduce violent crime and improve governmental effectiveness in Washington, D.C., June 7–July 30, 1993', Preliminary Technical Report [illegible] (Institute of

Science, Technology and Public Policy, Maharishi University of Management, Fairfield, IA).

Harries, K. D.: 1990, Serious Violence: Patterns of Homicide and Assault in America (Charles C. Thomas, Springfield, IL).

Hatchard, G. D., A. J. Deans, K. L. Cavanaugh and D. W. Orme-Johnson: 1996, 'The Maharishi Effect, a model for social improvement: Time series analysis of a phase transition to reduced crime in Merseyside metropolitan area', Psychology Crime & Law, 2(3), pp. 165–174.

Humphrey, J. A. and S. Palmer: 1986, 'Stressful life events and criminal homicide', Omega 17(4), pp. 299–308. Institute of Science, Technology and Public Policy: 1993, An experimental test in Washington, D.C. of a new program to reduce violent crime through collective stress reduction using the Transcendental Meditation program (unpublished document) (Maharishi University of Management, Fairfield, IA).

International Criminal Police Organization: 1994, International Crime Statistics: 1994 (Interpol General Secretariat, Lyons, France).

Johnston, J.: 1984, Econometric Methods (Third Edition) (McGraw-Hill, New York).

Kelling, G. L., T. Pate, D. Dieckman and C. E. Brown: 1974, The Kansas City Preventive Patrol Experiment: A Summary Report (Police Foundation, Washington, DC).

Lanford, A. G.: 1990, 'Reduction in homicide in Washington, D.C. through the Maharishi Technology of the Unified Field, 1980–1983: A time series analysis', in R. A. Chalmers, G. Clements, H. Schenkluhn and M. Weinless (eds.), Scientific Research on Maharishi's Transcendental Meditation and TM-Sidhi Program: Collected Papers, Volume 4 (Maharishi Vedic University Press, Vlodrop, Netherlands), pp. 2600–2608.

Larimore, W. E.: 1983, 'Predictive inference, sufficiency, entropy, and an asymptotic likelihood principle', Biometrika 70, pp. 175–181.

Larimore, W. E. and R. K. Mehra: 1985, 'The problem of overfitting data', Byte 10, pp. 167–180.

Leenars, A. A. and D. Lester: 1994, 'Domestic and economic correlates of personal violence in Canada and the United States', Giornale Italiano di Suicidologia 4(1), pp. 7–12.

Lester, D.: 1986, 'The interaction of divorce, suicide, and homicide', Journal of Divorce 9(3), pp. 103–109.

Lewis, D. O., R. Lovely, C. Yeager and D. D. Femina: 1989, 'Toward a theory of the genesis of violence: A follow-up study of delinquents', Journal of American Academic Child Adolescence Psychiatry 28(3), pp. 431–436.

Linsky, A. S. and M. A. Straus: 1986, Social Stress in the United States: Links to Regional Patterns of Crime and Illness (Auburn House, Dover, MA).

Liu, L.-M., G. B. Hudak, G. E. P. Box, M. E. Muller and G. C. Tiao: 1986, The SCA Statistical System: Reference Manual for Forecasting and Time Series Analysis (Scientific Computing Associates, DeKalb, IL).

Lyubimov, N. N.: 1992, 'Mobilization of the hidden reserves of the brain', in Program Abstracts of the 2nd Russian-Swedish Symposium, 'New Research in Neurobiology', (Brain Research Institute, Russian Academy of Medical Sciences, Moscow).

MacLean, C. R. K., K. G. Walton, S. R. Wenneberg, D. K. Levitsky, J. V. Mandarino, R. Waziri, S. L. Hillis and R. H. Schneider: 1996, 'Effects of the Transcendental Meditation program on adaptive mechanisms: Changes in hormone levels and responses to stress after four months of practice', Psychoneuroendocrinology 22, pp. 277–295.

Maharishi Mahesh Yogi: 1978, Enlightenment and Invincibility (Maharishi European Research University Press, Rheinweiler, Federal Republic of Germany).

Maharishi Mahesh Yogi: 1995, Maharishi's Absolute Theory of Government (Second Edition) (Age of Enlightenment Publications, India).

Maharishi Mahesh Yogi: 1996, Maharishi's Absolute Theory of Defence (Age of Enlightenment Publications, India).

Mauer, M.: 1995, 'A crime bill to bust budgets', State Government News, 38(4), p. 18.

McCleary, R. and R. A. Hay, Jr.: 1980, Applied Time Series Analysis for the Social Sciences (Sage Publications, Beverly Hills, CA).

Merton, R.: 1938, 'Social structures and "Anomie"', American Sociological Review 3, pp. 672–682.

Michael, R. P. and D. Zumpe: 1983, 'Annual rhythms in human violence and sexual aggression in the United States and the role of temperature', Social Biology 3, pp. 263–278.

Nelson, C. R.: 1976, 'The interpretation of R^2 in autoregressive – moving average time series models', The American Statistician 30, pp. 175–180.

Nidich, S. I., R. A. Ryncarz, A. I. Abrams, D. W. Orme-Johnson and R. K. Wallace: 1983, 'Kohlbergian cosmic perspective responses, EEG coherence, and the Transcendental Meditation and TM-Sidhi program', Journal of Moral Education 12(3), pp. 166–173.

Office of Juvenile Justice and Delinquency Prevention: 1993, Comprehensive Strategy for Serious, Violent, and Chronic Juvenile Offenders (Office of Justice Programs, U.S. Department of Justice, Washington, DC).

Office of Juvenile Justice and Delinquency Prevention: 1996, Juvenile Offenders and Victims: 1996 Update of Violence (Office of Justice Programs, U.S. Department of Justice, Washington, DC).

Orme-Johnson, D. W.: 1987, 'Medical care utilization and the Transcendental Meditation program', Psychosomatic Medicine 49(1), pp. 493–507.

Orme-Johnson, D. W.: 1994, 'Transcendental Meditation as an epidemiological approach to drug and alcohol abuse: Theory, research, and financial impact evaluation', Alcoholism Treatment Quarterly 11, pp. 119–168.

Orme-Johnson, D. W., C. N. Alexander, J. L. Davies, H. M. Chandler and W. E. Larimore: 1988, 'International peace project in the Middle East: The effects of the Maharishi Technology of the Unified Field', Journal of Conflict Resolution 32(4), pp. 776–812.

Orme-Johnson, D. W. and J. T. Farrow: 1977, Scientific Research on the Transcendental Meditation Program: Collected Papers, Volume 1 (Maharishi European Research University Press, Rheinweiler, Federal Republic of Germany).

Orme-Johnson, D. W., R. K. Wallace and M. C. Dillbeck: 1989, 'Longitudinal effects of the TM-Sidhi program on EEG phase coherence', in R. A. Chalmers, G. Clements, H. Schenkluhn & M. Weinless (eds.), Scientific Research on Maharishi's Transcendental Meditation and TM-Sidhi Program: Collected Papers, Volume 3 (Maharishi Vedic University Press, Vlodrop, Netherlands), pp. 1678–1686.

Peppler, D. J. and K. H. Rubin (eds.): 1991, The Development and Treatment of Childhood Aggression (Lawrence Erlbaum Associates, Hillsdale, NJ).

Petersilia, J.: 1993, 'Crime and punishment in California: Full cells, empty pockets, and questionable benefits' (CPS Brief) (California Policy Seminar, Berkeley, CA).

Phillips, D. P.: 1986, 'Natural experiments on the effects of mass media violence on fatal aggression: Strengths and weaknesses of a new approach', in L. Berkowitz (ed.), Advances in Experimental Social Psychology (No. 19) (Academic Press, New York).

Plosser, C. I. and G. W. Schwert: 1978, 'Money, income, and sunspots: Measuring economic relations and the effects of differencing', Journal of Monetary Economics 4, pp. 637–660.

Police Foundation: 1981, The Newark Foot Patrol Experiment (author, Washington, DC).

Pope, M. K. and T. W. Smith: 1991, 'Cortisol excretion in high and low cynically hostile men', Psychosomatic Medicine 53, pp. 386–392.

Prentice, D. A. and D. T. Miller: 1992, 'When small effects are impressive', Psychological Bulletin 112, pp. 160–164.

Raine, A., P. Brennan, B. Mednick and S. A. Mednick: 1994, 'Birth complications combined with early maternal rejection at age 1 year predispose to violent crime at age 18 years', Archives of General Psychiatry 51, pp. 984–988.

Raine, A., P. Brennan, B. Mednick and S. A. Mednick: 1996, 'High rates of violence, crime, academic problems, and behavioral problems in males with both early neuromotor deficits and unstable family environments', Archives of General Psychiatry 53, pp. 544–549.

Rainforth, M. V., C. N. Alexander and C. R. Bleick: in press, 'Transcendental Meditation program and criminal recidivism in Folsom State Prison, California: A 15-year follow-up', Journal of Offender Rehabilitation.

Reiss, A. J. and J. A. Roth: 1993, Understanding and Preventing Violence (National Academy Press, Washington, DC).

Roth, R.: 1994, Maharishi Mahesh Yogi's Transcendental Meditation (Revised Edition) (Primus, New York).

Sapolsky, R. M.: 1992, Stress, the Aging Brain, and the Mechanisms of Neuron Death (MIT Press, Cambridge, MA).

Sapolsky, R. M.: 1996, 'Why stress is bad for your brain', Science 273, pp. 749–750.

Seeman, T. E. and B. S. McEwen: 1996, 'Impact of social environment characteristics on neuroendocrine regulation', Psychosomatic Medicine 58, pp. 459–471.
Shaw, C. and H. McKay: 1942, Juvenile Delinquency and Urban Areas (University of Chicago Press, Chicago).
Sherman, L. W., D. Gottfredson, D. MacKenzie, J. Eck, P. Reuter and S. Bushway: 1997, 'Preventing crime: What works, what doesn't, what's promising'. A report to the United States Congress, prepared for the National Institute of Justice (Department of Criminology and Criminal Justice, University of Maryland, College Park, MD).
Shibata, R.: 1983, 'A theoretical view of the use of AIC', in O.D. Anderson (ed.), Time Series Analysis: Theory and Practice (No. 4) (North-Holland, New York), pp. 237–244.
Sommers, I. and D. R. Baskin: 1993, 'The situational context of violent female offending', Journal of Research in Crime and Delinquency 30(2), pp. 136–162.
Straus, M. A.: 1980, 'Stress and physical child abuse', Child Abuse and Neglect 45, pp. 75–88.
Subrahmanyam, S. and K. Porkodi: 1980, 'Neurohumoral correlates of Transcendental Meditation', Journal of Biomedicine 1, pp. 73–88.
Tannenbaum, F.: 1938, Crime and the Community (Ginn, Boston).
Travis, F. and D. W. Orme-Johnson: 1990, 'EEG coherence and power during yogic flying', International Journal of Neuroscience 54, pp. 1–12.
United Kingdom Prison Service: 1994, Prison Statistics, England and Wales (Government Printing Office, London).
U.S. Department of Health and Human Services: 1994, Healthy People 2000: National Health Promotion and Disease Prevention Objectives – Review 1994 (U.S. Government Printing Office, Washington, DC).
Vandaele, W.: 1983, Applied Time Series and Box-Jenkins Models (Academic Press, New York).
Vaux, A. and M. Ruggiero: 1983, 'Stressful life change and delinquent behavior', American Journal of Community Psychology 11(2), pp. 169–183.
Virkkunen, M., J. DeJong, J. Bartko, F. K. Goodwin and M. Linnoila: 1989, 'Relationship of psychobiological variables to recidivism in violent offenders and impulsive fire setters: A follow-up study', Archives of General Psychiatry 46, pp. 600–603.
Wallace, R. K.: 1970, 'Physiological effects of Transcendental Meditation', Science 167, pp. 1751–1754.
Wallace, R. K., P. J. Mills, D. W. Orme-Johnson, M. C. Dillbeck and E. Jacobe: 1983, 'Modification of the paired H-reflex through the Transcendental Meditation and TM-Sidhi program', Experimental Neurology 79, pp. 77–86.
Wallace, R. K., D. W. Orme-Johnson and M. C. Dillbeck: 1990 & in press, Scientific Research on Maharishi's Transcendental Meditation and TM-Sidhi Program: Collected Papers, Volumes 5 and 6 (Maharishi University of Management Press, Fairfield, IA).

Walton, K. G. and D. Levitsky: 1994, 'A neuroendocrine mechanism for the reduction of drug use and addictions by Transcendental Meditation', Alcoholism Treatment Quarterly 11, pp. 89–117.

Werner, O. R., R. K. Wallace, B. Charles, G. Janssen, T. Stryker and R. A. Chalmers: 1986, 'Long-term endocrinologic changes in subjects practicing the Transcendental Meditation and TM-Sidhi program', Psychosomatic Medicine 48, pp. 59–65.

Institute of Science Technology and Public Policy
Maharishi University of Management
Fairfield, Iowa
USA

John S. Hagelin
Maxwell V. Rainforth
Kenneth L. Cavanaugh
Charles N. Alexander
Susan F. Shatkin

Center for International Development and Conflict Management
University of Maryland
College Park, Maryland
USA

John L. Davies

Department of Humanities and Social Sciences
University of the District of Columbia
Washington, D.C.
USA

Anne O. Hughes

Crime Research and Statistics Section
Planning and Research Division
District of Columbia Metropolitan Police Department
Washington, D.C.
USA

Emanuel Ross