The PAPM, Diffusion Theory, and Violent Death Surveillance

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***Objective*: To Apply the PAPM and Diffusion Theory for building a statewide coroner investigation system to further violent death prevention efforts. *Methods*: By utilizing a theoretically based framework and systematically tracking stage progression, individual agencies and/or state systems can replicate and sustain the process. *Results*: Through the incorporation of the combined models, 82 of Kentucky's 120 coroner offices currently collect the same information—no replicate information existed 4 years ago. *Conclusion*: This study demonstrates the utility of theory as a foundation for encouraging adoption of innovation and shows an effective way to coordinate information in a timely manner with limited cost.**

***Key words*: PAPM, diffusion theory, violent death reporting, centralized reporting, coroner, investigative reporting, web-based system**

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Every year over 50,000 Americans die violently. In 2002, suicide was the second leading cause of death among 25- to 34-year-olds, and in the same year over 60% of all violent deaths were firearm related.[1] Better understanding of these traumatic, often high-profile, deaths is needed if effective prevention programs are to be developed. Until recently, researchers, health professionals, and policymakers have relied on death certificate data to understand and explain violent deaths. Problematically, death certificates cannot define important aspects of these cases, such as whether there was more than one person involved in a violent death incident, the circumstances surrounding the entire event, or the relationship between victim(s) and perpetrator(s).

In the Commonwealth of Kentucky, coroners are the highest ranking official at a violent death scene. They, along with medical examiners, crime laboratory personnel, and law enforcement personnel generate death investigation reports. When combined, results from these reports provide a more complete picture of a violent death than previously available through death certificates alone. Surprisingly, the investigative information collected by these professional entities usually remains unavailable or unusable to the investigating agencies themselves, to health professionals, and to researchers. In response, the Centers for Disease Control and Prevention (CDC) continues to build a national system to merge uniform violent death data (defined as all homicides, suicides, and firearm-related fatalities) from all states, for both individual and collective analysis. The Na-

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Figure 1
Chronology of Development

tional Violent Death Reporting System (NVDRS) provides timely and detailed information to "inform decision makers about the magnitude, trends, and characteristics of violent deaths." The NVDRS has become a tool that can be used for evaluation and continuous improvement of state-based violence prevention policies and programs.[2] For example, findings from the NVDRS's pilot test, the National Violent Injury Statistics System (NVISS), have led to strategies to prevent teen-related suicide, intimate partner violence homicide and suicide, grief-related suicides, health problems and suicide, and college-aged youth and suicide, and identification of neighborhoods with the highest rates of homicides leading to increased police protection.[3-5]

The CDC modeled the NVDRS after the Fatality Analysis Reporting System, which combines data to reduce the rate of motor vehicle-related deaths by improving road safety policies, child restraint use, safety belt use, rear restraint use, and vehicle safety standards.[6,7] The CDC initiated the NVDRS in 2002 with 6 initial states: Massachusetts, New Jersey, Maryland, Virginia, South Carolina, and Oregon. In 2003 7 additional states joined, bringing the total to 13. Kentucky joined the NVDRS September 1, 2004, as one of 14 previously funded states. California and New Mexico joined the NVDRS, alongside Kentucky, in 2004 bringing the total number of funded states to 17.

In anticipation of becoming a part of the CDC's NVDRS, with the financial support of the Kentucky Department for Public Health (KDPH), and with guidance and assistance from the NVISS, Kentucky launched a statewide Violent Death Reporting System (KVDRS) in January 2002. Between 2000 and 2002 the KDPH funded a project collecting all firearm-related fatalities; the KVDRS represented a considerable expansion of the existing Kentucky Firearm Injury Statistical Project (KFISP).

The KFISP was designed to reduce the rate of firearm-related fatalities by collecting circumstantial information from Kentucky coroners. Coroner reports were requested in 2000, 2001, and 2002 with a response rate of 28%, 24%, and 35% respectively. As a result of this low participation, a pilot study was conducted from July 2003- December 2003 to collect baseline data describing current practices and to evaluate statewide coroner reporting systems in each county (see Table 1 for a breakdown of coroner reporting at the end of 2003). Coroner reports were requested by mail with the intention of evaluating what information was being collected and what type of form utilized.

The 2003 pilot study was the first systematic review of coroner investigation reporting in Kentucky. The review revealed a system consisting of 120 independent county systems: 120 coroner offices; 120 elected coroners, most with a fluctuating number of appointed deputy coroners; 34 different investigation report forms, and 59 with no coroner record keeping (no legislation required any type of uniformity, consistency, or accountability—this has not changed). Of the 74% who responded to the mailing, only 13% used a report form that included more information than that recorded on death certificates; 48% relied on other documentation maintaining no official coroner report. County coroners not responding to the mail survey were contacted by the author by phone or in person at a coroner in-service training.

Understandably, various state officials deemed the centralizing of reporting from all 120 counties impossible. In this paper, we demonstrate how the use of theory,

Table 1
2003 Pilot Test

PAPM stage	Responded to mailing	Face-to-face interview	Total	%
No record keeping[a] (Stage 1, 2)	43	16	59	49%
Informal notes (Stage 1,2)	19	8	27	23%
Report form insufficient[b] (Stage 3/4,5)	15	3	18	15%
Report form sufficient[c] (Stage 6,7)	12	4	16	13%
Total	89	31	120	

Note.
a Relied on other official documents (police, toxicology, autopsy authorization, autopsy results, but no coroner report)
b Coroner form used, but did not include a history of the case and/or circumstantial information, only demographic information recorded on death certificates
c Coroner form included a history of the case and/or circumstantial information

the precaution adoption process model (PAPM) and diffusion theory (DT) provided a framework for structuring activities to move one investigating agency (in this case Kentucky coroners) through phases from being unaware to taking action and adopting the new reporting system. Results from this process provide a theoretically based framework for replication in other states.

The PAPM and Diffusion Theory

The PAPM is a stage model that was initially developed in research on adoption of radon testing.[8-11] The PAPM begins with a stage in which there is lack of awareness of an issue and progresses through a stage in which awareness develops but with a lack of engagement in change, to decision making regarding change, to taking action to change, and finally to maintenance. The model is dynamic in the sense that it supports different patterns of change, ranging from a smooth progression through stages to change occurring in fits and starts. Different barriers may be faced in each stage, and failure in overcoming a certain barrier might move an individual backward and a success with a barrier in a past stage might push an individual forward 2 stages. The stage structure and its dynamic nature make the PAPM well suited to the process of coroner adoption of standardized reporting. The transtheoretical model, a well-known theory that also proposes that change occurs in stages, was considered for this project but was not selected because of its focus on the individual, an attribute that makes it less suited for the present problem.[12] Diffusion theory (DT)[13] also provides a useful structure for investigation of adoption among coroners.

A key principle of diffusion theory (DT) suggests that new information spreads through a population in stages. The first stage is adoption by innovators. The experience of the innovators encourages adoption by a series of segments of the population; the early adopters, early majority adopters, late majority adopters, and laggards. DT has been instrumental in study of adoption of many innovations that are similar to CIRS.[14-19] In this study, we used elements of the PAPM and diffusion theory to systematically track stage progression for each county and to formulate messages, based on stage, encouraging movement to the next stage.

METHODS

A statewide implementation of a new system for violent-death reporting requires not only an individual approach, but also a community effort. With 120 counties in the Commonwealth of Kentucky, and 4-year elections causing turnover, a sustained individualistic approach was not feasible. Additionally, if the new system is to be replicated in other larger states, individual networking would be impossible. By integrating DT into the PAPM, messages could be tailored de-

Table 2
Overview of the Coroner Investigation Reporting System Development and Implementation

PAPM stage	Diffusion Attributes	Diffusion Plan	Contact	Support	Maintenance	Key Statements
Unaware (Sept. 2001-Nov. 2004)	Innovation Development Continuous: Communicability Relative advantage	Gain support of early adopters, they promote relative advantage as CIRS diffuses	Approach Board of the Kentucky Association of Coroners (KAC)	Board approval and ongoing support	Keep KAC informed of CIRS development and diffusion plans	This is something that really needs to be done.
Mapping System Phase: Purple	Trialability	CIRS innovation development		Pilot test CIRS design prior to dissemination	Continue development of CIRS	All coroners could benefit by using this.
Unengaged (Sept. 2001-Nov. 2004)	Impact on social relations	CIRS diffuses to key players, they promote CIRS as apartnership	Interpersonal networking	"Buy in" by influential coroners	Word of mouth diffusion from county to county	If we all use the CIRS coroner investigation reporting would be consistent across the state.
Mapping System Phase: Purple/Blue		Channel choices	Request to talk at annual coroners' conference and required trainings	Attempt to reach all coroners (as reach, change to Blue)	Begin marketing CIRS to all coroners/deputy coroners	This program is free, and not legislated.
Deciding whether to act		CIRS promotion	Attend all coroner in-service training to reach all coroners/ deputy coroners (not all attend the annual conference)	Department of Criminal Justice Training support, allow for presentations at all in-service trainings	Offer personal program installations and training	I've used the same report for 20 years. Why should I change?
Mapping System Phase: Blue/Red	Observability	Use color coded mapping system to track diffusion of CIRS: Coded as Red here if interested	Use maps during presentations/talks— promote competition between counties	State Medical Examiner Office offers formal support		What do I have to do to become a "Yellow County"
Deciding not to act **Mapping System Phase: Blue**	Compatibility, Complexibility, Time, Risk, Uncertainty level Modifiability	CIRS improvements: offer county specific CIRS modifications, develop a simpler tool (MS Word version), develop notebook version develop a noncomputer version	Interpersonal networking	Develop CIRS in OMNI form application following suggestion from 5 county coroners		The CIRS is too hard to use. I don't know anything about computers. I don't have MS Access on . my computer
Deciding to Act	Trialability Reversibility Modifiability	CIRS trial, application choice, change/modifications if version doesn't work	Program installation directly or by E-mail/ phone	Individual coroners/deputy coroners: word of mouth	Improve computer skills with training sessions) during installation and/or at trainings	I've decided to change my reporting and have tried the ____ version of CIRS and think I may institute this report in my office for all coroners' cases.

Table 2 (continued)

Diffusion PAPM stage	Diffusion Attributes	Plan	Contact	Support	Key Maintenance	Statements
Mapping System Phase: Blue/Red/Yellow	Observability	Use color coded mapping system: Change to Yellow	Generally the coroner initiates contact			
Acting	Commitment Modifiability	Linkage agent to prevent and solve problems CIRS reporting tested	Provide training in place of introducing CIRS Generally the coroner initiated contact	Tailor program individually, including county-specific drop-down menus	Updates and modifications for each county	I'm using the CIRS for all coroner investigations.
Mapping System Phase: Yellow						
Maintenance Mapping System Phase: Yellow	Commitment	Sustained through Institutionalization	Continue talks at annual coroners' conference and required trainings	Help each other when problems arise		This is what we all use for our investigations.
Mapping System Phase: Green	Modifiability	Develop a web-based CIRS version for a statewide electronic database	Promote web-based version through presentations	IT support for web-based application	Offer a web-based version of CIRS and start all over again as the "new tool."	I can use the CIRS anywhere—it's more convenient.

pending on the individual's stage of change, and that individual in turn could move forward and become a resource for the process of distributing the message to the population.

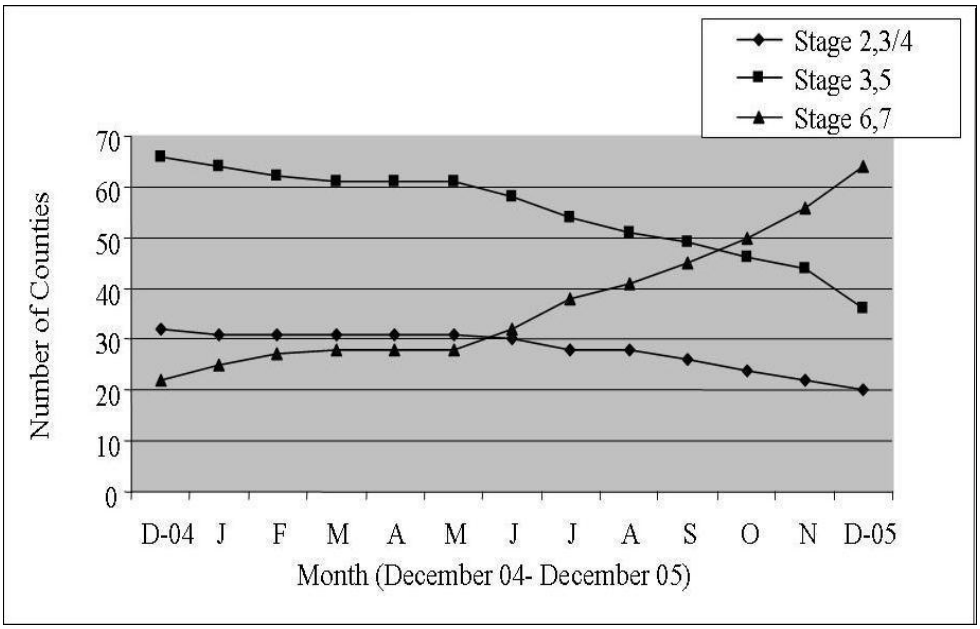
Table 2 provides an overview of the development and implementation of the coroner investigation reporting system (CIRS)[20] using the PAPM and DT. Weinstein and Sandman assert that the PAPM stages represent individual differences and experiences where factors that produce transitions between stages vary depending on the specific transition being considered.[11] Organizing 120 Kentucky coroners into using statewide reporting required flexibility in approach, message, and distribution depending upon the stage. A one-size-fits-all approach was likely to miss hard-to-reach individuals. This would be unfortunate because in many cases, maintaining their engagement simply required a redirection of the approach, the message, or the distribution.

By combining the use of the PAPM with a diffusion plan, an individual Kentucky coroner would move through various stages and at the same time contribute to diffusion of the new system throughout the Commonwealth. Coroners transitioning to higher stages of the PAPM would be the best promoters of the CIRS to coroners in previous stages.

Individuals who are unaware of the issue (PAPM stage I) would be those who have not heard of the CIRS initiative for statewide uniform reporting and, if made aware, those who would likely deny its applicability to them or their county. A smaller-county coroner (defined in this study as <100 coroner cases per year) might conclude that only those counties with more than 100 cases annually would need a program. A larger-county (defined as >100 coroner cases per year) coroner might conclude that reporting already met a high standard, making it unnecessary to join with smaller counties.

The initial review of Kentucky's coroner system at the end of the pilot study in 2003 found 72% of county coroners/deputy coroners in stage I or stage II (Table 1). In approximately 108 of the 120 counties in Kentucky, the position of coroner is part time. The rigorous duties of coroners require almost continually on call duty and going off duty only when deputy coroners can cover (all counties have individual restrictions on how many deputies

Figure 2
CIRS Adoption by PAPM (stage by month)



are allowed). Kentucky coroners are in contact with one another generally at times of joint investigations, during more involved cases, at required in-service trainings (18 hours per year), and the annual coroners' conference. Apart from these infrequent interactions, coroners generally operate exclusively within the confines of their own county, making even the idea of uniform statewide reporting foreign.

Innovation Development

The Kentucky Coroner Association's (KCA) board is dominated by coroners and deputy coroners who have been in those roles for 20 or more years. Board members have a vested interest in the Commonwealth and are considered opinion leaders, experts in the field, and early adopters. Successful adoption of the new model depended largely on board members endorsing the centralization objectives. The greatest advantage presented to, and agreed upon, by the KCA board was the idea that the model for implementing the CIRS essentially allowed the coroners to centralize themselves (without legislative force), satisfying strong opposition to current coroner reporting and the lack of accountability.

In 2002, the KCA board permitted the implementation of a uniform reporting system across the Commonwealth's 120 counties, becoming part of the innovation development. Using Kentucky coroner investigation reports, CDC recommended variables and elements contained in the National Violent Injury Statistical System,21 the author developed the CIRS. The CIRS is an informational system specifically tailored to Kentucky coroners. The CIRS affords Kentucky's coroners the ability to collect the same information in various applications or forms: Microsoft Access Application, with optional web access; Microsoft Word; OMNI™ Form Application, and a hard copy version for those without computers.

The diffusion attributes of relative advantage, and communicating advantages effectively, are incorporated into every PAPM (phasing) stage: introducing the CIRS to early adopters and majority adopt-

Table 3
Summary of Uptake

PAPM stage	Baseline Data	December 2004	December 2005
(Stage 1, 2)[a]	86	32	20
(Stage 3/4,5,6,7)[b]	34	88	100[c]

Note.
a Relied on other official documents (police, toxicology, autopsy authorization, autopsy results, but no coroner report)
b Coroner form used
c Fifty-two used the CIRS, 12 used a form which included the same information as the CIRS in a different format; 36 used a coroner form which did not include a history of the case and/or circumstantial information.

ers, explaining the advantages of becoming part of a statewide system, finding new advantages and modifications for those who decide not to act, and convincing those who drop off to jump back on board. Relative advantages are expressed through project staff to the coroner group as a whole, to board members, and during individual trainings. Word of mouth among coroners/deputy coroners currently utilizing the system remains the optimal method of convincing additional county coroners to implement the CIRS.

RESULTS

The CIRS was pilot tested in the Microsoft Access application in a large county (>100 cases) by one county coroner/KCA board member. He determined the system contained all pertinent information for a Kentucky coroner investigation. The application was then tested in a smaller county coroner office (<100 cases) where concern over the complexity was raised. A simpler version was developed in Microsoft Word and pilot tested in 3 additional counties (<100 cases). Additionally, the board was updated on all CIRS development and asked for ongoing involvement in the process.

By December 2004 the CIRS had been presented at the annual coroners' conference and all in-service trainings reached nearly all coroners and deputy coroners with information about the CIRS. Since then, most have begun to form opinions and, therefore, no longer reside in stage I, but have advanced to stage II: unengaged by the issue (Table 2). A visual simplification of the process for communication with coroners/deputy coroners included breaking down the PAPM stages of change by color. A geographical information system map of the state with counties colored by stage provided an incentive to become part of the statewide system or at least become similar to neighboring counties. Maps were used in presentations and distributed at in-service trainings to encourage questions about color distribution. Purple represented PAPM stage I (unaware) and stage II (unengaged)—those in stage II know a moderate amount about the CIRS without considering an obligation to act.

Because coroners are elected to serve 4-year terms, there is inevitably turnover. With the turnover, the implementation of the new system was dependent upon word-of-mouth support. "Buy in" from coroners able to stay in office for multiple terms (most of the KCA board) allowed for continuous word-of-mouth diffusion about the advantages of being part of a statewide reporting system. Promotion of the system at the annual coroners' conference occurred in May 2002 and has continued since then. In addition, the support of The Department of Criminal Justice Training (DOCJT), which is the agency that coordinates the mandatory coroner training, was obtained. With DOCJT support, CIRS presentations at all 15 in-service trainings began in 2004 allowing for individual discussions during breaks and lunches. Presentations continue and involve education on the importance of statewide reporting, how to accomplish the goal, and how a statewide system benefits individual counties and

Kentucky as a whole. Speaking only at the annual conference of coroners proved insufficient; nearly each county coroner needed to be convinced that this system was a valid and potentially necessary system. The 2 venues have worked in tandem to provide a foundation of familiarity, crucial for individual uptake of a statewide system.

The PAPM stage of deciding about acting allows for observable progress. Figure 2 shows the breakdown of coroner involvement in the CIRS phasing system between December 2004 and December 2005.

Phase blue counties were aware of the CIRS, but reporting had not been evaluated. Blue counties relied on other official documents and/or kept informal notes, and didn't use a coroner form. Counties designated red maintained a county reporting system, but failed to collect information deemed necessary for entrance into a uniform statewide system. Phase yellow counties collect all information defined as essential and are considered part of the statewide reporting system—CIRS. Table 3 is a summary of the uptake of the CIRS from the pilot study thru December 2005.

Once initial contact was made and information disseminated about the CIRS, the task of encouraging movement to action began. Weinstein, in writing about the PAPM, states that people will weigh the costs and benefits of an action and will act if the benefits outweigh the costs. Additionally, people will say they intend to act, but do not follow through on good intentions for various reasons and obstacles.[8] For this very reason, a coroner or deputy coroner might request a version of the CIRS at an in-service training, by mail, phone, or e-mail, but that county will not move to phase yellow until a test is performed and a case (or sample case), recorded on a version of the CIRS, is evaluated. Coroners generally welcome the opportunity to be walked through the new technology.

Lists of in-service training attendees help in preparing for in-service presentations. If most attendees are in phase blue, basic CIRS information is relayed; if most attendees are in phase red, presentations involve discussion about the CIRS and possible improvements. Several diffusion attributes are emphasized: compatibility (the CIRS can be modified to meet the needs of an individual county); simplicity of the system (versions include everything from an application in which cases can be queried to a handwritten version for those without computers); installations and training can be completed in less than an hour, and there is nothing to lose (if the coroner or deputy coroner decides he doesn't like the program he can cease to use the CIRS without any financial consequence and any risk of damaging the currently used county system).

A coroner may receive all pertinent information, including free technical support, but may not recognize the value in a statewide system, and decide not to act. The most prominent reasons a coroner decides not to act (17% by December 2005) include viewing involvement as unnecessary, additional work; believing their particular county is free of complicated cases; lacking the time—approximately 90% of coroners/deputy coroners work other full-time jobs; or lacking a personal computer, without the means to purchase one.

Not all resistance is negative, and those that have and continue to decide not to act have not been silent and vocalize their position. Coroners may decide to act, but may lack the ability to do so; they may see the benefit of a systematic computerized reporting system, but simply do not have the time or skills to introduce any more work to their job duties. These instances allow for modifications of the CIRS and the development of the CIRS in other applications. Approximately 23 coroners/deputy coroners have articulated barriers resulting in nearly a dozen improvements. One example of an improvement is a notebook version of the CIRS resulting from conversations with 2 coroners and 4 deputy coroners who had decided not to act (no access to a computer). The notebook design fits into a pocket or bag for easy access at the scene of a violent death and allows counties to collect information uniformly starting at the crime scene, and with all applications matching. Later, whether by the coroner, deputy, or office associate, the CIRS information easily transfers to a computer (if possible) or handwritten forms. The CIRS notebook version can also be copied and faxed to agencies requesting reports.

At the annual conference and in-service trainings, coroners who have de-

cided to act ask questions, look over various CIRS applications, and set up appointments to either receive an application through E-mail, through mail on a floppy or compact disk, or establish an appointment for a personal installation and training at their county office.

The KVDRS staff act as the linkage agent as opposed to enforcer and have assumed the role of helping, supporting, and encouraging county coroner offices

The final phase is maintenance (phase: green), which is a web-based application allowing the CIRS to be incorporated into a statewide electronic coroner database. Considering approximately 90% of coroners/deputy coroners work additional part-time and even full-time jobs, they have the ability to enter cases anywhere they have Internet access. This frees coroners/deputy coroners from being bound to one office desktop computer to using laptops in the field (with wireless connection ability), other desktops at other sites, or on their home computers.

DISCUSSION

Kentucky coroners, as an integral part of their communities, are uniquely positioned to interface with their communities in times of grief and crisis, and by documenting the circumstances, assist prevention efforts. Most coroners are willing to provide information and work toward centralization given a clear understanding of expectations, recognition for sacrificial service to the community, and the hope of prevention.

A streamlined reporting system, clarity in communicating the process, and computer training are key factors in gaining participation. The Internet provides endless possibilities for public health interventions from surveillance to community programmatic prevention efforts. Results from 2 studies find great value in the utilization of web-based information systems offering more easily accessible formats.[22,23] The simplicity and practicality of entering information directly into a web-based system outweighs the initial intimidation many professionals experience, but underscores the necessity of computer training.[23]

As Kentucky's phasing system moves forward to include all county coroners, violent-death data-collection efficiency will improve, allowing for more timely dissemination—a benefit for not only violence prevention and control, but also terrorism preparedness and response.[24] Wisconsin's development of a statewide, web-based reporting system to centralize coroner and medical examiner reporting in all 72 counties was initiated to identify bioterrorism-related deaths, disease, and injury to identify outbreaks, bioterrorism activities, and prioritize health issues. Much like the system in Wisconsin, a centralized system in Kentucky would offer a great deal of understanding in preventable deaths and deaths requiring immediate consideration.[25] This process has broader implication, however, than the seemingly provincial study of coroner reporting in one or 2 states. According to Hanzlick and Combs, 27 states operate with decentralized death investigation systems, meaning investigations are conducted in more than one regional, county, or city-based office.[26] In the wake of increased homeland security, it is surprising how many states are unable to access pertinent death-scene information in a timely manner at the state level much less in cases of national public health and safety. With this in mind, states with decentralized death investigation systems might take this model of success in Kentucky and transpose it to launch centralization efforts.

Few studies invoke the DT as the basis for innovation institutionalization, yet this systematic dissemination, at a time when public health informatics is burgeoning, makes this study all the more important. By combining the stages of change offered by the PAPM with DT, a systematic yet simple grassroots approach can effectively lead to the development of a centralized information system. This is an effective way to reach a disparate group of individuals in a reasonable amount of time and with minimal overall cost.

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