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Aspirin use and cardiovascular events in social networks

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ABSTRACT

We tested whether friends' and family members' cardiovascular health events and also their own aspirin use are associated with the likelihood that an individual takes aspirin regularly. Analyses were based on longitudinal data on 2724 members of the Framingham Heart Study (based in Massachusetts, U.S.A.) who were linked to friends and family members who were also participants in the same study. Men were more likely to take aspirin if a male friend had recently been taking aspirin, and women were more likely to take aspirin if a brother had recently been taking aspirin. Men were also more likely to take aspirin if a brother recently had a cardiovascular event, and women were more likely to take aspirin if a female friend recently experienced a cardiovascular event. Aspirin use is correlated with the health and behavior of friends and family. These findings add to a growing body of evidence which suggests that behavioral changes that promote cardiovascular health may spread through social networks.

Introduction

A large body of evidence shows that aspirin reduces cardiovascular events for patients with and without histories of cardiovascular disease (CVD) (Berger et al., 2006; Campbell, Smyth, Montalescot, & Steinhubl, 2007; Eidelman, Hebert, Weisman, & Hennekens, 2003; Farley, Dalal, Mostashari, & Frieden, 2006). However, several national studies reveal that aspirin is underutilized (Pignone, Anderson, Binns, Tilson, & Weisman, 2007; Stafford, 2000). Increases in aspirin use have been slow given its efficacy, and rates remain low, particularly among outpatients (Stafford & Radley, 2003). Using the 2003 Behavioral Risk Factor Surveillance Survey, Ajani, Ford, Greenland, Giles, and Mokdad (2006) report adjusted aspirin prevalence rates of 69.3% and 32.7% for individuals with and without CVD. They also find less aspirin use among women than men (adjusted prevalence for women was 34% and for men 38.5%).

Given that aspirin is inexpensive, available without a prescription, and its health benefits have been relatively widely publicized (e.g., industry-initiated advertising campaigns), much of the variation in aspirin use is likely to be determined by factors outside of the clinical setting. While having had a conversation with one's doctor about aspirin is an important determinant of aspirin use in national samples (Brown et al., 2002; Pignone et al., 2007), discrepancies between medical records and self-reports suggest than many people take aspirin on their own initiative without their doctor's knowledge (Brown et al., 2002).

It seems reasonable to suppose that having a member of one's social circle (i.e., an "alter") experience a cardiovascular event and/or begin taking aspirin is likely to affect an individual's (i.e., an "ego") aspirin use. Health behaviors and risk factors (e.g., obesity, smoking) may be "socially contagious," and the chances that one changes his/her own behavior are increased if a member of one's social network recently began behaving differently (e.g., with respect to diet, exercise, smoking, or drinking) (Christakis & Fowler,

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2007, 2008; Rosenquist, Murabito, Fowler, & Christakis, 2010). Aspirin-use may have a comparable dynamic of social diffusion. Having a friend or family member experience a cardiovascular event and/or begin taking aspirin may increase an ego's odds of aspirin-use by increasing his/her awareness of CVD and aspirin prophylaxis. Alters' events and aspirin-use could also raise ego's subjective assessment of personal cardiovascular risk and improve his/her attitudes toward aspirin use. This work departs from prior work in that it evaluates both the similar behaviors in alters (aspirin use) and also events occurring in alters (e.g., cardiovascular illness) with respect to how they affect ego.

Methods

The Framingham Heart Study Social Networks Study

The Massachusetts, U.S.A. Framingham Heart Study (FHS) began in 1948 with an Original Cohort of 5209 adults. In 1971, the FHS added an Offspring Cohort comprised of 5124 adult children of the Original Cohort and their spouses. In 1994, a minority oversample of 508 people known as the "Omni Cohort" was empaneled. Beginning in 2002, 4095 adults having at least one parent in the Offspring Cohort enrolled in the Third Generation Cohort, along with 103 parents of the Third Generation Cohort participants who were not previously enrolled in the Offspring Cohort. As a means of following participants, the FHS collected regular contact information for participants' close friends and family members. Since the FHS cohorts are family-based and participants are drawn primarily from the Framingham, Massachusetts area, many of the friends and family members that were listed as contacts are also participants in FHS. Connecting participants (i.e., egos) at each wave to their contacts who were also participants (i.e., alters) gives researchers longitudinal data on a network of social connections among participants. Combining these network data with data from periodic physical exams and questionnaires allows us to test how alters' recent events and behaviors impact egos.

The Framingham Heart Study protocol is reviewed by the Boston University Medical Center Institutional Review Board and participants signed written informed consent. Our project was additionally reviewed by the Harvard Medical School Institutional Review Board.

Study sample

Longitudinal data for our analysis come from physical exams and questionnaires performed during three-year periods centered at 1985, 1989, 1992, 1997, and 1999. We limit our analysis to egos who are likely candidates for aspirin prophylaxis—that is, women age 55–70 and men ages 45–79. All egos are from the Framingham Offspring Cohort, while alters may be in any of the Framingham cohorts. In this analysis, we include three types of intimate peer relationships: spousal relationships, sibships, and friendships. We select these relationship types because we expect egos to be more sensitive to events/behaviors among alters they identify with and feel close to. An insufficient number of observations and events made it impossible to examine gender-stratified parent–child relationships.

In the data for our analysis, information on egos' and alters' health events, behaviors, and social ties are time-varying across waves. If a respondent lists a friend as a contact in one wave, but not in the next wave, that tie is dissolved and is not included in subsequent waves. If an alter dies between the last and current wave, we include information about the health events leading to his/her death in the current wave, but that tie will be dissolved and is not included in all subsequent waves. Examining ego-alter ties across all waves, 32% of the observations are spousal ties, 58% are sibling ties, and 11% are friendships.

Study variables

The dependent variable for this analysis is a dichotomous indicator for whether ego is taking aspirin on a daily basis at the time of the current wave. The key predictors of interest are whether alter was taking aspirin on a daily basis at the last wave and whether alter had a cardiovascular event between the last and current waves. Specific cardiovascular events included in the alter event measure are: myocardial infarction, angina pectoris, coronary insufficiency, stroke, intermittent claudication, and death from CVD or stroke.

We include a lagged version of the dependent variable as a predictor to adjust for whether ego was taking aspirin at the last wave. We also adjust for whether ego has ever had his/her own cardiovascular event prior to the current wave. The measure of ego's prior events includes: myocardial infarction, angina pectoris, coronary insufficiency, stroke, and intermittent claudication. Other control variables are ego's age, education, marital status, and survey wave.

Statistical analysis

The longitudinal logistic regression model employed in our analysis can be written as:

$$\ln\left(\frac{Y^e_{it}}{1-Y^e_{it}}\right) = \alpha + \beta_1 X^a_{1ir(t,t-1)} + \beta_2 X^a_{2ir(t-1)} + \beta_3 X^e_{3i(t-1)} + \beta_4 X^e_{4it} + \beta_5 X^e_{5it} + \beta_6 X_{6t} + e_{irt}$$

where the superscript e indicates a variable measuring an ego characteristic and a superscript a indicates a variable measuring an alter characteristic. The subscript i refers to individual ego, i, the subscript r refers to relationship, r, with a given alter, and the subscript t refers to a given wave at time t. Y^e_{it} is the dichotomous dependent variable indicating whether ego used aspirin at the current wave. $X^a_{1ir(t,t-1)}$ is a dichotomous variable indicating whether alter experienced a cardiovascular health event between the last wave $(t-1)$ and the current wave (t). $X^a_{2ir(t-1)}$ is a dichotomous variable indicating whether alter was taking aspirin at the last wave. $X^e_{3i(t-1)}$ is a dichotomous measure of whether ego was taking aspirin at the last wave. X^e_{4it} is a dichotomous measure of whether ego had a cardiovascular health event at any time prior to the current wave. X^e_{5it} reflects the set of controls for ego's characteristics (e.g., age, education, marital status). X_{6t} reflects the set of controls for survey wave. And, finally, e_{irt} is an error term specific to each ego-alter pair at a given wave. To account for clustered error terms resulting from ego-alter pairings and multiple observations of the same egos across waves, we use generalized estimating equations with an independent working correlations structure (Hardin & Hibe, 2002).

After presenting a model for all ties combined, we stratify the analysis according to ego's sex, the sex-composition of the tie (i.e., two males, two females, or a male and female), and the type of relationship (i.e., spouses, siblings, and friendships). Aspirin-use is lower among women than men, and evidence of the preventative benefits of aspirin is somewhat more controversial for women than men (Ajani et al., 2006; Mulrow & Pignone, 2005). We further expect that people may be more likely to identify with and take behavioral cues from same-gender alters, and that alter's influence on ego may differ depending on the type of relationship they share (i.e., spouses, siblings, friends).