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Personal Emergency Response Systems Achieve Positive Outcomes

Personal emergency response systems on the home care team help achieve positive outcomes: lower hospital utilization and increase communication between providers and patients.

Although then representing only slightly over 12% of the U.S. population, in 1987 older persons constituted 42% of hospital admissions and 31% of discharges (U.S. Dept. of Health and Human Services, 1993). In 1987, the average length of stay per discharge was 8.7 and 9.8 days for older males and females, respectively, in the United States (National Center for Health Statistics, 1992). Notwithstanding that these rates are down from a high of 14.0 days per discharge in 1969, if these rates of hospitalization continue, the generally recognized increase in the 65+ age group will have a significant impact on hospitals, e.g., 66% of Medicare expenditures go to hospitals, which, in 1987, cost U.S. taxpayers \$47.3 billion (Waldo et al., 1989); total inpatient charges of almost \$145 billion from all non-Federal hospitals comprised 32% of annual expenditures for personal health services in 1990 (Levit et al., 1991).

The PERS we investigated is Lifeline Systems, Inc., the founder of the PERS industry in the U.S. almost 20 years ago, which now serves over 250,000 users in the U.S. and Canada (Montgomery, 1992). The Lifeline Program is a 24-hour emergency response service activated by an FM frequency alert transmitter worn by the subscriber. Program subscribers use two pieces of equipment in their home: a small waterproof personal help button worn on a neck chain or as a wristband and a home communicator connected to the residential telephone line. The communicator is activated when the button is depressed, relaying a "help needed" signal to the Emergency Response Center (ERC) located in the emergency department of a local hospital or in a community health center. Program monitoring staff are thus alerted and a response cascade is initiated to arrange for appropriate help. If the elder cannot reach the phone or speak to the ERC staff over the built-in speaker phone, then the first person designated as a responder, usually a relative or neighbor, is called. If no designated responder can be reached, then an ambulance is dispatched to the person's home. When responders arrive, they depress the flashing yellow reset bar on the communicator to let the ERC know that help has arrived.

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Five studies have been conducted on the Lifeline Systems, Inc. model of equipment and PERS response protocol:

1) Sherwood's and Morris' (1980) team studied elderly tenants in the Boston and Cambridge, Massachusetts Housing Authority. Three separate groups were designated depending on the degree of physical frailty and social isolation. A total sample of 551 persons was randomly designated as either experimentals (those offered Lifeline) or controls (those not offered Lifeline). At the end of the three-year study, a cost/benefit analysis was completed on the two targeted matched samples, users vs. non-users, resulting in a 7.19 benefit/cost ratio. This ratio indicates that for every one dollar spent on Lifeline, there was a resulting savings of \$7.19. Cost savings were also found regarding delay of nursing home placement in this study; i.e., for every one day of nursing placement for the experimentals, the controls required 13 days. An Institute of Medicine (1991) report on the power of research to reduce health costs concluded that postponing by one month the placement of older persons in nursing homes could save \$3 billion annually, minus the cost of home health services during that month.

2) Koch (1984) found that the utilization of a PERS program not only greatly assisted with discharge planning, but PERS users experienced a 26% reduction in length of hospital stay.

3) Dibner (1992) replicated Koch's study with 70 Lifeline PERS users associated with four Boston hospitals. Lifeline users' medical records in the year following installation of a Lifeline unit were compared to the users' prior three-year hospital utilization rates. Even after statistically adjusting for the general trend of decreased hospital use, users' post installation rates reflected a 26.4% decrease in admissions, a 23.2% decrease in length of stay, and a 6.5% decrease in emergency room visits.

4) Cain (1987) conducted an interesting study upon 70 patients at the Jerry L. Pettis Memorial Veterans Administration Hospital in Loma Linda, California. Whereas most Lifeline users are older women living alone, these patients were younger (73 years of age), mostly male (97%), and far fewer lived alone (16%). Over a two-year period of time, these VA patients, when compared to their pre-Lifeline hospital admission rates, experienced dramatic reductions in both admissions (48.4%) and in days hospitalized (69.3%).

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5) Roush et al. (1994) presented data at the Annual Meeting of the American Geriatrics Society in Los Angeles comparing hospital utilization before and after subscription for the 106 subjects in Langley, British Columbia (mean age=78.6 years, female=76.4); while analysis revealed no significant change in ER visits (0.58 vs. 0.72, $p=0.4$), there was a significant drop in mean hospital admissions (1.18 vs. 0.88, $p=0.03$) and a significant drop in mean days of hospitalization (14.37 vs. 5.85, $p=0.01$).

Problem

Based on our findings in the above cited Canadian study, we undertook an analysis of a data set on a comparable group of U.S. older adults. This led us to answer this question: "Does use of a Personal Emergency Response System (PERS) similarly affect hospital admission rates among users in the two different communities?"

Methods

The research settings were the clinical facilities with ERCs from which the data for these two parallel studies were collected. They are located in Langley, British Columbia and in Tallahassee, Florida. Although no direct funding is available from the hospital budget, office space and professional monitoring staff are provided at no charge to the Lifeline Program. Volunteers form an integral part of the programs. Monthly monitoring fees averaging \$30.00 are charged to the subscriber.

The study population consisted of all persons who had subscribed to the Lifeline PERS program of Tallahassee Memorial Regional Medical Center for at least one full year were identified ($n=101$). For each identified subscriber, hospitalization usage data were collected by abstracting charted data for one year prior to and one year after initial subscription to the program. The comparison group comprised 106 Lifeline PERS program subscribers from an urban Canadian setting. Identification of subjects for the Canadian comparison group occurred in similar fashion, and has been described previously (Roush et al., 1994). Hospital utilization data regarding this comparison group was from 1991-1993.

Descriptive data for 101 Tallahassee Lifeline subscribers revealed a wide age range (36-93 years); however, both mean and median ages (76.5 and 77 years, respectively) indicate that this was a predominately older group of individuals, of whom 87% were female, not an unexpected percentage for this age group. A power analysis for the study of Tallahassee subscribers, based on an alpha of 0.05 and a power of 0.8 revealed that a sample size of 100 unique persons would be adequate to detect a mean change of 3.5 hospital days, or a 33% change from the pre-PERS average length of hospital stay. We consider an effect size of this magnitude to be clinically significant. Data for 101 persons were available for study. Statistical analyses included a description of the Tallahassee data and a comparison of known demographic features and hospital utilization rates before and after PERS use.

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Outcome measures included the number of emergency room visits made per person and the total number of hospital in-patient days per person for each year of study, i.e., one year without PERS use and one year with PERS use. Paired t-tests were employed to measure the significance of possible change in these parameters after subscription to the Lifeline PERS program in Tallahassee. Even though it was unlikely that the PERS program would be associated with significant increases in hospital utilization, two-tailed tests were performed to maintain strong methodological rigor. Comparisons were then made between the Canadian and American settings, based on the number of emergency room visits and the total number of hospital days. Differences were considered significant when $p < .05$.

Results

For the Tallahassee data, the number of emergency room visits prior to subscribing to Lifeline ranged from 0-7 and averaged 1.13 per person. Emergency room visits decreased slightly during the subscribers' first year of PERS use to an average of 1.07 visits per person, although this observed drop was not statistically significant ($p=0.76$).

The total number of hospital days per subscriber during the year prior to PERS use ranged from 0 to 87. The mean number of days was 10.45 and the median was 8 days; 44% had no hospitalizations and six persons were hospitalized over 30 days during the year prior to PERS use. Per person hospitalization dropped to an average of 6.22 days during the year of PERS use, with a range of 0 to 76 days. This average reduction of 4.3 days of hospitalization per subscriber per year was statistically significant at $p=0.014$.

Regarding pooled data, a comparison was made between Lifeline PERS program subscribers at Langley to those at Tallahassee. There was no substantive difference in age between the two samples. The Tallahassee sample had slightly more female subscribers, however, the difference was small and the statistical significance was borderline ($p=0.47$). The mean number of emergency room visits was significantly greater in the Tallahassee sample when compared to the Langley sample. An explanation for this discrepancy would only be conjecture without additional data collection. There was no difference in the mean number of ER visits after PERS program subscription; however, the difference between groups does preclude attempts to pool the two study sites for statistical testing of change in ER use with subscription to a PERS program.

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There was no statistically significant difference between the Tallahassee and Langley samples regarding the mean number of hospital days for either one year prior to, or one year following Lifeline PERS program subscription. This suggests that a pooled analysis may be valid for this particular measure. The mean number of hospital days for 207 subjects dropped by 6.5 days. This 50% drop was statistically significant ($p=0.0007$), indicating some association with subscription to the PERS program and reduced hospital inpatient days.

Conclusions

These data tend to support a hypothesis that PERS programs can be effective in reducing hospital utilization. In both the Canadian and U.S. hospitals studied, statistically significant reductions in inpatient days were associated with use of the Lifeline personal emergency response systems versus subjects' hospital admission experience prior to program subscription. No statistically significant changes in emergency room visits was associated with the use of the PERS.

While this may be good news both to seniors looking for interventions that increase independence and to health care providers interested in reducing annual health care costs, caution must be taken in generalizing these findings to all community-residing elderly. In the present retrospective study, hospital utilization data one year prior to use of a PERS device were compared to that of the year immediately following PERS use.

Although demographic data were constant in this self-paired analysis, our use of only abstracted chart data did not permit us to perform multiple regression analyses to measure the percentage of the variance that might be explained by such other personal characteristics as health status, economic factors, living arrangements, or amount of in-home help that may have changed for certain subjects unbeknownst to us. Since such potential influences can be expected to occur in a random fashion, we felt the potential confounding effects would be equally distributed across the sample.

Commentary

In the study reported herein, users and their formal and informal caregivers reported heightened feelings of security in knowing that they were electronically tethered to a nearby Emergency Response Center. Is this feeling of added security a potential halo effect? PERS program managers in the two test sites report this as being perhaps the most significant factor associated with earlier discharge and subsequent reduced hospital usage. Notwithstanding this, the findings and conclusions of the Langley and Tallahassee studies need to be confirmed in prospective, controlled trials to substantiate the strength of the apparent association between use of Lifeline's PERS Program and significant decreases in hospital admission rates. Should these associations stand the scrutiny of well controlled studies, then perhaps we should

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heed the suggestion by Kane, Ouslander, and Abrass (1994) that just as physicians comfortably prescribe drugs, they should also be prepared to prescribe environmental interventions when necessary. Such environmental prescriptions include alterations in the physical environment, special services, and increased social contact through telephone reassurance. Thus, when indicated by a patient's health status and social circumstance, recommending a PERS might be the appropriate environmental prescription.

Furthermore, if quality of care can be maintained via in-home care that results in marked reductions in hospital usage by older PERS users, then perhaps a reduction of some magnitude in Medicare expenditures would follow. Were this to be documented prospectively, the obvious policy question would be raised: "Should not reimbursement for modest monthly PERS charges be included in health care reform packages that emphasize preventive measures?" A final note is this: almost without exception, older persons prefer to stay in their own homes as long as possible; thus, the future of health care in North America should emphasize any measure designed to effect that wish.

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