TECHNOLOGY AND WEB-BASED SUPPORT

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MANY TYPES OF technology support caregiving:

- Assistive devices include medicine dispensers, feeding and bathing machines, clothing with polypropylene fibers that stimulate muscles, intelligent ambulatory walkers for those with both vision and mobility impairment, medication reminders, and safety alarms (Axisa et al., 2006; Freedman et al., 2006; Pollack, 2006).

- Telecare devices ranging from ordinary telephones to picture phones. Electronic stethoscopes, glucometers, respirometers, pulse oximeters, and vital sign sensors are among the available telemonitoring devices (Schultz et al., 2002).

- Computer-based services include read-only Internet information, software for cognitive improvement exercises, caregiving decision-making support driven by artificial intelligence, and Web-camera conferences that connect family members in different locations (Bowles & Baugh, 2007).

- "Smart" homes with sensors (Joseph Rowntree Foundation, 2007; Rialle et al., 2002) identify patterns in daily activities, provide caregiving prompts to administer medications, and send an alert to a monitoring party if a problem such as wandering is detected (Stefanov et al., 2004).

- Robotic assistants follow older adults to guide them to specific locations in the home and connect electronically to health care professionals,[9] improve orientation by playing recordings of the date and time and of daily activities, and offer social and mental stimulation (Stiehl et al., 2006).

- Caregivers with no technologic experience can use such devices and services (Barlow, 2004). Public demand is high for telemonitoring systems, which are sold by unlicensed and unregulated private manufacturers.

Telecare Services

A National Library of Medicine review reported that 50,000 households were using telecare services in 2006, and the number was increasing rapidly (Hersh et al., 2006). Most U.S.

telemonitoring programs are for homebound older adults, veterans, or rural residents (Hersh et al., 2001a). Only six states had telecare services for mental health, and only two states used this technology in inner cities (Hersh et al., 2006).

Nurses can make about eight times as many telecare visits with older patients per day as they can in-home visits (Rooney et al., 1997). However, because of reimbursement constraints, fewer than 200 of the 7,000 Medicare-certified home health agencies regularly use telecare (Hersh et al., 2001b; Whitten, 2006). Metaanalyses and national evaluations reveal that access to health care professionals and lower costs are the main reasons the costs of remote technology services are reimbursed (Currell et al., 2001; Whitten et al., 2000).

"Smart" Home Services

The number of homes that have "smart" technology has not been verified. Older adults rate telehealth monitoring of their cognitive status as acceptable and home surveillance systems as positive. They report that the benefits of staying in their homes and being connected with family members and health care professionals outrank their privacy concerns (Lehoux, 2004; Matthews, 2006).

The Internet

Chronically ill people of all ages, ethnicities, and economic groups rate computerized health information as very useful. In addition, many caregivers routinely use the Internet to educate themselves.

Blue-collar workers, the elderly, and caregivers have dramatically increased their use of the Internet for obtaining health information

(Fox, 2006, 2007; Fox & Rainie, 2004). Yet a "digital divide" persists, with less Internet availability for and fewer studies of use of the Internet by ethnic groups or disadvantaged families (Hsu et al., 2005; Kaufman & Rockoff, 2006).

The Evidence Base

There is consistent evidence in favor of providing caregiving education and information via the Internet and two-way picture telephones. But clinical trials on technologic assistance for those requiring care at home and evidence of cost-effectiveness are limited. In addition, most studies have not specifically addressed outcomes in family caregivers.

The Internet

Reviews of Web sites have concluded that the health information they provide is generally accurate, although coverage is incomplete, the reading level is high (high school or above), and little is available in Spanish or other languages (Berland et al., 2001). In addition to providing information, interventions that use the Internet can offer useful social and cognitive stimulation (Schultz et al., 2002).

A 2004 metaanalysis found that only nine of 144 Internet intervention studies met the criteria for clinical trials (Davis Kirsch & Lewis, 2004). These nine trials demonstrated gains in user knowledge. A 2007 systematic review (Glasgow, 2007) identified several efficacious Internet-based interventions, including caregiver education (Smith et al., 2002b), chronic disease management, and interactive support and treatment follow-up (Gustafson et al., 2002; Pare et al., 2007).

Effects on caregivers. Early studies found that caregivers of people with Alzheimer's

disease who used computer links had improved depression, anger, social isolation, confidence, and decision making (Bass et al., 1998; Brennan et al., 1995; Wright et al., 1998). More recent reports on technology for assisting caregivers of older people cited increased senses of control, confidence, and support, as well as greater involvement of distant family members (Czaja & Schultz, 2006; Dauz et al., 2004; Kelly et al., 2007; Schultz et al.,2002).

Only two of the 144 Internet intervention studies reviewed by Davis Kirsch and Lewis included caregivers (Davis Kirsch & Lewis, 2004). In these two studies, caregivers' sense of support with use of the Internet improved significantly compared with that of controls (Bass et al., 1998; Krishna et al., 2003).

Picture Phones

Two Health Services Technology Assessment reports (from the Agency for Healthcare Research and Quality) reviewed efficacy studies of telecare using two-way picture phones and found it had benefits for home management of chronic diseases (Hersh et al., 2001b, 2006). Two reviews of numerous outcome studies and clinical trials indicated that home picture-phone contacts had similar or better results than outpatient visits for patients of various ethnic and age groups with chronic illnesses (Hersh et al., 2001a; Johnston et al., 2000). A Cochrane review of seven home care clinical trials concluded that picture phones were reliable and well accepted by families and that their use resulted in improved functional status and fewer ED visits and hospitalizations among elderly people (Currell et al., 2001). A recent clinical trial of in-home picture-phone visits found significant improvement in treatment adherence among an older population at a cost that was much lower than that of home visits (Smith et al., 2006).

Effects on caregivers. Using picture phones for hospice care has been well received by caregivers and verified as cost-effective, although the technology is underused (Day et al., 2007). Caregivers have stated that using telecare to assess their concerns is comparable to having a nurse present and that the technology is worth paying for (Smith et al., 2002a). Systematic reviews that include data on caregivers have noted that clinical trials involving either picture-phone telecare or Web-camera monitoring showed improved outcomes for homebound older adults and improved quality of life for family caregivers (Hersh et al., 2006; Davis Kirsch & Lewis 2004).

Models of Web–Based Support for Caregivers

Several Web-based support programs for caregivers are briefly described here. More extensive information can be found online at http://links.lww.com/ATKTK.

- The Comprehensive Health Enhancement Support System was developed by health care and informatics experts at the University of Wisconsin–Madison (Gustafson et al., 2002). Professionals now advise caregivers by e-mail, conduct assessments by Web camera, model caregiving procedures in video clips, and maintain data on care recipients (Center for Health Enchancement Systems Studies, 2008; Glasgow, 2007).
- Virtual Nurse Caring is a program in which nurses use step-by-step algorithms

and Web-based video scenes to guide home care (Smith, 2005).

- The Visiting Nurse Association (VNA) network translated decades of experience with standardized interventions into telecare protocols that are used by 900 VNA agencies (see http://innovativehcs.com).

- Caregiver multimedia training programs are available on some workplace Internet sites. For example, IBM enables employees to access online information on caring for parents (Beauchamp et al., 2005).

Education on Technology–Based Care

The projected shortfall in health care professionals in all fields may necessitate the creation of new career paths based in gerontology and technology. The workforce must be capable of selecting appropriate technologies and using evidence-based assessments and interventions matched to caregivers' needs. Clinicians need to be able to conduct visual, two-way telemonitoring visits and to interpret the monitored data.

The Health Information Technology Scholars project is teaching nursing faculty at three midwestern universities (the University of Kansas, the University of Colorado–Denver, and Indiana University) to implement and integrate information technologies into their nursing curricula (Connors et al., 2007). Tailoring interventions and protocols that result in beneficial outcomes for care recipients, caregivers, and health care costs is an educational priority.

It is not known whether professionals must acquire different communication and information-giving skills to deliver technology-based care. Whether the use of technology might alter criteria for professional licensure and malpractice insurance is still being explored.

Professionals as well as caregivers need to learn to judge the quality of Web sites. The Health on the Net Foundation (www.hon.ch) has established a code of principles by which Web sites are evaluated. Any health-related Web site can request accreditation by this system.

Relationships and Ethics

Few studies have examined how technology-assisted delivery of care affects the relationship between practitioner and patient (Murray et al., 2003). Studies of the effect of technology on nurses have found mainly positive outcomes (Arthur et al., 2001). One untoward consequence of technology-based care may occur if the caregiver misunderstands some information found on the Internet (Kinney & Kart, 2006). Another cited possibility is that constant monitoring might create a false sense of security and result in neglect of the care recipient.

Ethical concerns related to the use of technology include the appropriateness of constant surveillance and the privacy of personal health data. Lack of access to technology may create inequalities in care for some older adults and caregivers.

Research Priorities

Despite the large number of studies on technology-based care, many have methodologic flaws, such as a small sample size, a lack of statistical rigor, and limited outcome measurements. There are few longitudinal studies or randomized controlled trials. To be sure, some studies of technology have used psychometrically tested instrumentation,

qualitative research methods, and adequately powered samples and have been solidly grounded in caregiving or social science theory. But it would not be judicious to consider the findings overall as high-quality evidence for technologic assistance in caregiving.

Research is necessary to determine which interventions, assessments, chronic care protocols, clinical guidelines, and therapeutic services can be reliably, sensitively, and safely delivered by technologic means. Other research questions concern the coordination, cost-effectiveness, and reimbursement of such care. Comprehensive models that link technologic care to older people and their caregivers are needed. Among the questions to be explored are: Can software programs of monitored data be used to trigger alerts for caregiving? Can national clinical guidelines be automated into decision-making algorithms and home care guides that are useful for caregivers?

Important studies aimed at improving the development of technology and training for older adults are in progress (Czaja et al., 2006). Further areas for study include regulations on technology use and adequacy of staffing for technology-assisted caregiving services. For example, what are the adequate staff sizes and appropriate education for call-center employees that will enable safe management of home monitoring data and an adequate response to emergency alerts?

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