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JRRD Guest Editorial

Electronic aids for daily living

OVERVIEW

Electronic aids for daily living (EADLs) are devices used to help people access, operate, and control electrical appliances in the home, school, or workplace. The primary purpose of an EADL is consistent performance of necessary daily tasks. These devices also maximize functional ability and independence. Other names for EADLs are environmental control systems and environmental control units.

Persons who use and benefit most from these devices are those with severe physical limitations that affect their mobility and upper limbs. Common diagnoses are tetraplegia, muscular atrophy, muscular dystrophy, cerebral palsy, multiple sclerosis, and amyotrophic lateral sclerosis.

EADLs are controlled either by an ability switch, touch screen, voice recognition, or integrated with other controls; controls can be integrated with computer access, wheelchair controls, or augmentative communication devices. For persons who use a switch to operate an EADL, a dual switch offers more control by allowing them to scan and select at their own speed and ability. Single-switch operation requires the user to activate the device by scanning through a list of choices, which limits the speed of operation to the scanning speed programmed into the unit. Integrated controls that operate an EADL are helpful and often necessary when a person has a limited number of switch-control sites available. For example, by integrating controls, a person can operate an environmental control system through the same controls ("sip'n'puff" switch, joystick, head array, etc.) used to operate a wheelchair.

CATEGORIES

Two broad categories of EADLs exist: computer-based and stand-alone. A computer-based EADL is a combination of hardware and software that is added to a computer system and allows control of the environment. A stand-alone EADL does not rely on a computer for its function. In general, a computer-based voice-activated EADL can offer superior voice recognition, vast amounts of visual and auditory feedback and prompting, and superior programmability. Although a computer-based system can be used for other functions in addition to control of the environment, the system becomes more vulnerable to viruses, glitches, and crashes. Stand-alone EADLs are not subject to the general vulnerabilities that can plague a computer system that is used for multiple applications. Stand-alone systems usually offer fewer options in terms of feedback, prompting, and programmability. Stand-alone systems are often more easily transported. Additional EADL resources can be

found in the **Appendix** (available online only at http://www.rehab.research.va.gov).

EADL feedback to the user may be visual or auditory. Visual feedback can be either static or dynamic. Static visual feedback could include a fixed label on each option. Dynamic visual feedback allows the options to change in accordance with the user input or option being presented. Auditory feedback could be in the form of a beep or a given word or phrase. Depending on the EADL, a combination of visual and auditory feedback is possible.

DEVICES TO CONTROL

Common types of electrical appliances controlled by EADLs are telephones, lights, door openers, door locks, fans, drapes, blinds, beds, audiovisual equipment, home climate controls, call systems, and security cameras. These appliances are usually controlled by one of the following methods: (1) infrared (IR), (2) X-10, and (3) direct connection.

IR controls many different appliances in the same way a television remote control. IR transmission requires "line of sight." As a result, the controlling signal cannot operate a device located in another room or even in the same room if the two devices cannot "see" one another with a ray of light. If a device requires IR control, an IR extension cable or distribution box can be used to extend the signal to the remote area. Alternatively, IR can be transformed into a radio frequency (RF) signal, which will allow more pervasive transmission of the signal.

X-10 is an industry standard for communication among devices used for home automation. It uses household wiring (electric power line) to carry shortwave RF signals to the devices to be controlled. This type of control is limited to turning devices on and off. Lights can also be dimmed or brightened. In many cases, the home electrical service does not need to be modified. INSTEON is a newer technology that sends dual signals—a power line communication, like X-10, as well as an RF signal that travels through the air. INSTEON has several reliability advantages over X-10: (1) two different types of signals are sent; (2) if the receiving device does not obtain a clear signal, the sending device resends the signal; and (3) each receiving device resends the signal once it is received. This allows the network to be stronger as more devices are added. INSTEON is also backward-compatible with X-10 and accepts multiple addresses.

Direct connection implies that other devices are connected to the EADL unit. These devices can include telephone lines, intercom systems, bed controls, external speakers/microphones, IR extenders, and external relays.

ELECTRONIC AIDS FOR DAILY LIVING EVALUATION CONSIDERATIONS

When someone is deciding on an EADL, many factors must be considered, namely personal factors, equipment, environment, and funding. Personal factors include accessibility needs, preferences, cognitive and physical abilities, technology background, desire to use technology, degenerative conditions, and voice quality and changes. Other factors to include when considering equipment are the place(s) the EADL will be used, the layout and size of each area, the devices to be controlled, the electrical condition of the controlled environment, the bed/chair mounting, the switch type, the required integration with existing assistive technology equipment, and the particular EADL limitations and benefits. Funding has always been a limiting factor and can be the largest hurdle in obtaining equipment; funding factors include cost and the goals or requirements of the funding agency.

FUNDING

The basic cost of a full EADL system can range from $3,500 to $6,000. A completely installed system with door openers and other options can cost $8,000 to $15,000. Typically, the only funding available for EADLs is from vocational rehabilitation agencies, the Department of Veterans Affairs, workers' compensation, civil and nonprofit organizations, and philanthropists. Medical insurance does not cover EADLs; however, medical insurance in the United States differs from medical insurance in other countries. Some

countries consider EADLs part of their health benefits. In the United States, they are not seen as a medical necessity and, therefore, are not funded by medical insurance providers.

Individuals who can benefit from these devices need to be educated about and informed of the increased quality of life they can offer. Some individuals purchase elaborate televisions, stereos, and other electronic devices; however, EADLs are usually considered devices that someone else should provide. Often, when a drastic medical catastrophe does occur, personal funds are channeled to other needs that take precedence.

THE FUTURE

Due to lack of funding in general, technology transfer into EADL devices has been slow. Companies in a small market have difficulty keeping abreast of and incorporating the latest technology in their systems because technology is a fast-moving and ever-changing target.

For the EADL market to change drastically in the United States, funding for the devices will likely need to become more accepted. Such a funding change will only occur if insurance providers can see cost reductions in attendant or long-term care. Objective, widespread, conclusive studies have not been conducted to prove this benefit.

The use of EADLs may find greater support as these devices are integrated with other technologies. Augmentative communication devices are being recognized a medical necessity in some cases and are being funded by insurance companies. Since many of these devices cannot perform EADL functions, some growth in this area may be expected. In addition, environmental control capabilities are now being integrated into wheelchair controls, which may also help to expand the EADL market.

As people who have grown up in the technological age become candidates for this type of technology, a stronger acceptance and desire to obtain this type of equipment will likely exist. Voice recognition and wireless access are becoming more commonplace for computers and EADLs, so systems based on these technologies will also likely increase. The widespread use and availability of cellular telephones, wireless personal area networks, and Voice over Internet Protocol technologies may also find their place among EADLs. Finally, smart home technology is becoming more prevalent and will likely help further the use of EADLs.

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