Electronic Monitor for Monitoring TV Viewing Time
Description and Significance

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Abstract: Sedentary behaviour is related to adverse cardiometabolic risk profiles and premature mortality. Television (TV) viewing time is the most predominant sedentary behaviour. There are also adverse associations between TV viewing time and a number of cardiovascular risk factors such as the metabolic syndrome, obesity, and abnormal glucose metabolism. Few measurement tools, such as direct observation and videotaping, have been utilized to objectively monitor TV watching. Unfortunately, these measurements have shortcomings as they invade the personal privacy and are impractical in large-scale research studies. Therefore, there is a need for alternative objective measures. Therefore, the main aim of this paper is to design an electronic device to objectively monitor TV viewing. This device uses Radio-frequency identification (RFID) technology that transfers data using tracking tag that is attached to a child's wrist like a watch. This data will be collected by the RFID Reader which is connected to a main electronic board that is designed to measure TV viewing time in minutes. The current research is expected to produce a novel wireless electronic tool that can monitor TV viewing without intrusion to the person privacy and can be widely used as an objective method of assessing TV viewing time.

1 INTRODUCTION

The prevalence of type 2 diabetes mellitus (T2D) is increasing dramatically throughout the world. Globally, the number of people who were diagnosed with T2D was estimated at 110 million in 2002, and this number is estimated to reach 220 million in 2010 (Zimmet, 2000) and 300 million in 2025 (King et al., 1998). In Australia, 1 in 4 people over the age of 25 years has T2D or impaired glucose metabolism (Dunstan et al., 2001). Since 1981, the number of cases of T2D in Australia has increased threefold, and this number was projected to reach 1.23 million by 2010 (Australian Institute of Health and Welfare, 2005). Between 2002 and 2003, diabetes and its complications were the leading causes of death for more than 20,000 Australians aged 25 years and over (Dixon and Webbie, 2005).

Obesity, a major risk factor in the development of T2D and increased morbidity and mortality, has also increased rapidly in recent decades (Steinberger and Daniels, 2003, Haslam and James, 2005). In Australia, the prevalence of obesity has more than doubled in the past 20 years and it has been estimated that over seven million (60%) Australian adults aged 25 years and over are overweight, and over two million (21%) obese (Cameron et al., 2003). Further to this, the economic cost of obesity is very high; for example, in Australia, the total financial cost of obesity in 2005 was estimated at $AU21 billion (Access Economics, 2006).

It is well known that reduced physical activity is one of the leading causes of the increased prevalence of obesity among children and adults (Blair, 1993; Hill and Peters 1998). In addition to physical inactivity, sedentary behaviour is believed to be a separate entity that could play a role in the aetiology of T2D. Recently, a number of researches have demonstrated that physical activity and sedentary behaviors are two independents entities. Sedentary behaviour is shown to be related to adverse cardiometabolic risk profiles and premature mortality (Lollgen et al., 2009).

Television (TV) viewing is the most predominant sedentary behaviour and has been used as a measure of sedentary behaviour. There is also an accumulating evidence to suggest that there are adverse associations between TV viewing time and a

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number of cardiovascular risk factors such as the metabolic syndrome and obesity, abnormal glucose metabolism, and T2D (Hu et al. 2003; Dunstan et al. 2005; Dunstan et al. 2007; Wijndaele et al., 2009). Moreover, in cross-sectional studies for both adults and children, TV viewing time was found to be the predominant leisure-time sedentary behaviour that may have negative effects on overweight and obesity (Owen et al., 2000). In a recent cross-sectional study, TV viewing time was also associated with cardio-metabolic biomarkers, but not with computer use and reading time in an Asian population (Nang et al., 2013).

It is recommended that children younger than 2 years of age should not spend any time watching TV and for children aged between 2 to 5 years TV viewing time should be limited to less than one hour per day (Commonwealth Department of Health and Aged Care, 2010). In general, children should not spend more than 2 hours a day watching TV. It is also recommended that extended periods of inactivity through participation in sedentary activities such TV watching should be avoided by both children and youth. In a study conducted in Australian young adults, it was found that TV viewing more than 3 hours per day was associated with abdominal obesity, and this association was partly explained by the mounts of food and beverage consumption during TV viewing time (Cleland et al., 2008). This finding supports the possible explanation for the associations of sedentary behaviors with unhealthy dietary habits. Children and adolescents tend to consume more drinks and foods while watching TV. When sedentary behaviors and consumption of unhealthy diets are combined, this may contribute to the aetiology of obesity in children and adolescents independent of reduced physical activity.

In longitudinal study, physical activity and weekly TV viewing were estimated by a self-report in a cohort of 6369 girls and 4487 boys aged between10 to15 years (Taveras et al., 2007). In this study, Taveras et al. (2007) have found no substantial relationships between year- to- year changes in TV viewing and changes in leisure time moderate to vigorous physical activity, suggesting that TV viewing and leisure-time physical activity are separate constructs.

TV viewing is usually assessed by using a questionnaire that has a single question about daily or weekly TV viewing. It is known that self-reported measures suffer from some amount of reporting error. Therefore, measurement error in TV viewing time may lead to weaken the observed findings from previous studies.

Few studies used an objective measurement to monitor TV watching, such as direct observation and videotaping (Anderson et al., 1985; McKenzie et al. 1992; Ferguson et al., 2006). Unfortunately, these later measurements of TV viewing time have shortcomings since they are invasive to the person's privacy and they may change individual behaviours. They are also considered as impractical when used in large-scale research studies. Therefore, there is a need for alternative objective measures to monitor TV viewing time. To the best of our knowledge, no studies have assessed TV viewing with an objective measure such as an electronic device. Therefore, the main aim of this paper is to describe the design of an electronic device intended to objectively monitor TV viewing time.

2 DESCRIPTION OF THE ELECTRONICS

The electronic TV monitor is comprised of three elements: a tracking tag (a wrist watch), a reader, and main electronic board. This electronic TV monitor uses Radio-frequency identification (RFID) technology. RFID is a wireless and non-contact radio-frequency that transfers data automatically using identifying and tracking tag (i.e. RIFD tag) that is placed to a child's wrist like a watch. The RFID Reader is connected to a main electronic board which is designed to measure the TV viewing time in minutes when the RFID tag is detected by the RFID Reader and the TV is switched on. The main electronic board is composed with 24V Battery, ATmega8 microcontroller, Voltage Regulator, RS232 adapter, and RFID Reader to receive data from the RFID tag (Picture 1).

3 SIGNIFICANCE OF THE TV MONITORING DEVICE

This electronic device is considered a novel TV monitor that is able to capture the time that a person is spending in front of TV (or similar device). Such technologies will enable us to objectively monitor the real time spent in a very common pastime behaviours. For the first time, the direct monitoring of person's sedentary behaviours that are related to TV viewing will be achieved with intruding personal privacy and without much influencing such behaviours by the measurement itself.

TV monitoring will also be relatively inexpensive and can store information over a long period of days or weeks. Consequently, the device is expected to fill a gap in assessing one of the most predominate sedentary behaviour, TV viewing. The device is now designed with large memory storage so that several days of TV viewing can be measured objectively. Future research is needed to test reliability and validity of this electronic device.

Picture 1: Description of the electronic TV monitor.

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REFERENCES

Access Economics., 2006. The economic costs of obesity. Report for Diabetes Australia (2006).

Australian Institute of Health and Welfare., 2005. Costs of Diabetes in Australia, 2000-01, *Australian Institute of Health and Welfare,* Canberra.

Anderson, D. R., D. E. Field, et al, 1985. Estimates of young children's time with television: a methodological comparison of parent reports with time-lapse video home observation. Child Dev 56(5): 1345-1357.

Blair, S. N., 1993. Evidence for Success of Exercise in Weight Loss and Control. Ann Intern Med 119(7_Part_2): 702-706.

Cameron, A. J., Welborn, T. A., Zimmet, P. Z., Dunstan, D. W., Owen, N., Salmon, J., Dalton, M., Jolley, D. and Shaw, J. E., 2003. Overweight and obesity in Australia: the 1999-2000 *Australian Diabetes, Obesity and Lifestyle Study* (AusDiab). Med J Aust, 178, 427-32.

Cleland V. J., Schmidt M. D., Dwyer T, Venn A. J., 2008. Television viewing and abdominal obesity in young adults: is the association mediated by food and beverage consumption during viewing time or reduced leisure-time physical activity? Am J Clin Nutr, 87(5):1148–1155.

Commonwealth Department of Health and Aged Care., 2010. *National Physical Activity Guidelines for Australians:* Active Australia, Canberra, Australia, Commonwealth Department of Health and Aged Care, 2010.

Dixon, T. and Webbie, K., 2005. Diabetes-related deaths in Australia, 2001-2003. (Bulletin no. 32) Canberra: Australian Institute of Health and Welfare.

Dunstan, D. W., J. Salmon, et al., 2007. Association of television viewing with fasting and 2-h postchallenge plasma glucose levels in adults without diagnosed diabetes. Diabetes Care 30(3): 516-522.

Dunstan, D. W., J. Salmon, et al., 2005. Associations of TV viewing and physical activity with the metabolic syndrome in Australian adults. Diabetologia 48(11): 2254-2261.

Dunstan, D., Zimmet, P. Z., Welborn, T., Sicree, R., Armstrong, T., Atkins, R., Cameron, A., Shaw, J. and Chadban, S. (2001) Diabesity and associated disorders in Australia. The accelerating epidemic. Melbourne: International Diabetes Institute.

Ferguson, A. C., R. A. Canales, et al., 2006. Video methods in the quantification of children's exposures. J Expo Sci Environ Epidemiol 16(3): 287-298.

Haslam, D. W. and W. P. James., 2005. Obesity. Lancet 366(9492): 1197-1209.

Hill, J. O. and J. C. Peters., 1998. Environmental contributions to the obesity epidemic. Science 280(5368): 1371-1374.

Hu, F. B., T. Y. Li, et al., 2003. Television watching and other sedentary behaviors in relation to risk of obesity and type 2 diabetes mellitus in women. JAMA 289(14): 1785-1791.

King, H., R. E. Aubert, et al., 1998. Global burden of diabetes, 1995-2025: prevalence, numerical estimates, and projections. Diabetes Care 21(9): 1414-1431.

Lollgen, H., A. Bockenhoff, et al., 2009. Physical activity and all-cause mortality: an updated meta-analysis with different intensity categories. Int J Sports Med 30(3): 213-224.

McKenzie, T. L., J. F. Sallis, et al., 1992. Anglo- and Mexican-American preschoolers at home and at recess: activity patterns and environmental influences. J Dev Behav Pediatr 13(3): 173-180.

Nang EE, Salim A, Wu Y, Tai ES, Lee J, Van Dam RM., 2013. Int J Behav Nutr Phys Act., 2013. Television screen time, but not computer use and reading time, is associated with cardio-metabolic biomarkers in a multiethnic Asian population: a cross-sectional study. May 30;10(1):70. (Epub ahead of print)

doi:10.1186/1479-5868-10-70.

Owen N, Leslie E, Salmon J, Fotheringham M. J., 2000. Environmental determinants of physical activity and sedentary behavior. *Exerc Sport Sci* Rev 28 : 153 – 158.

Steinberger, J. and S. R. Daniels., 2003. Obesity, Insulin Resistance, Diabetes, and Cardiovascular Risk in Children: An American Heart Association Scientific Statement From the Atherosclerosis, Hypertension, and Obesity in the Young Committee (Council on Cardiovascular Disease in the Young) and the Diabetes Committee (Council on Nutrition, Physical Activity, and Metabolism). *Circulation* 107(10): 1448-1453.

Taveras E. M., Field A. E., Berkey C. S., Rifas-Shiman S. L., Frazier A. L., Colditz G. A., Gillman M. W., 2007. *Longitudinal relationship between television viewing and leisure-time physical activity during adolescence. Pediatrics* 2007; 119: e314-e319.

Wijndaele, K., N. Duvigneaud, et al., 2009. Sedentary behaviour, *physical activity and a continuous metabolic syndrome risk score in adults*. Eur J Clin Nutr 63(3): 421-429.

Zimmet, P., 2000. Globalization, coca-colonization and the chronic disease epidemic: can the Doomsday scenario be averted? *Journal of Internal Medicine* 247(3): 301-310.