ผลของเครื่องหมายจุดวกกลับและคำสั่งต่อการทดสอบ Timed Up and Go ในเด็กปกติ

นางสาวอิก้า กัสแลนดา บุสแทม

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
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Effects of the Turning Point Markers and Verbal Instructions on the Timed Up and Go Test in Typical Children

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อิก้า กัสแลนดา บุสแทม : ผลของเครื่องหมายจุดวกกลับและคำสั่งต่อการทดสอบ Timed Up and Go ในเด็กปกติ (Effects of the Turning Point Markers and Verbal Instructions on the Timed Up and Go Test in Typical Children) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: ผศ. ดร. สุจิตรา บุญหยง, 80 หน้า.

การศึกษานี้ศึกษาผลของเครื่องหมายจุดวกกลับ (เส้น, กรวย, และรูปภาพ) และคำสั่ง (ไม่ใช่เชิงคุณภาพและเชิงคุณภาพ) ต่อการทดสอบ Timed Up and Go (TUG) ในเด็กปกติอายุระหว่าง 6 ถึง 12 ปี เด็กปกติจำนวน 210 คน (เพศชาย 105 คน และเพศหญิง 105 คน) เข้าร่วมในการศึกษานี้ โดยผู้เข้าร่วมวิจัยถูกแบ่งเป็น 7 กลุ่มตามอายุ ผู้เข้าร่วมวิจัยได้รับการทดสอบ TUG ใน 6 เงื่อนไขด้วยวิธีการสุ่ม (3 เครื่องหมายจุดวกกลับ × 2 คำสั่ง) ผลการศึกษาพบว่า เวลาที่ใช้ในการทดสอบ TUG ลดลงในเด็กทุกกลุ่มอายุเมื่อใช้รูปภาพและคำสั่งเชิงคุณภาพ ($p<0.05$) เวลาที่ใช้ในการทดสอบ TUG มีความหลายหลายตามอายุ เครื่องหมายจุดวกกลับ และคำสั่ง อย่างไรก็ตาม มีการลดลงของเวลาใช้ในการทดสอบ TUG แบบไม่เชิงเส้นเมื่ออายุเพิ่มขึ้นในเงื่อนไขใดก็ตาม เด็กอายุ 12 ปี ใช้เวลาสั้นที่สุดและเด็กอายุ 6 ปี ใช้เวลานานที่สุด ผลการศึกษานี้แสดงให้เห็นว่าผลลัพธ์ของการทดสอบ TUG ในเด็กปกติได้รับอิทธิพลจากอายุ เครื่องหมายจุดวกกลับ และคำสั่ง ดังนั้น การใช้การทดสอบ TUG ในเด็กปกติจึงควรพิจารณาเลือกใช้เครื่องหมายจุดวกกลับ และคำสั่งที่เหมือนกัน เพื่อที่เปรียบเทียบผลลัพธ์ของการทดสอบ TUG ทั้งก่อนและหลังการทดสอบ และระหว่างกลุ่มอายุ

ภาควิชา กายภาพบำบัด ลายมือชื่อนิสิต .....

สาขาวิชา กายภาพบำบัด ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

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This study investigated the effects of the turning point markers (line, cone, and picture) and verbal instructions (non-qualitative and qualitative) on the Timed Up and Go (TUG) test in typical children aged 6 to 12 years. Two hundred and ten typical children (105 boy and 105 girls) participated in this study. They were divided into seven groups according their age. All participants were asked to randomly perform TUG test in 6 conditions (3 turning point markers × 2 verbal instructions). The results showed that the reduction of time spent performing TUG test was found in every age group when applied a picture and qualitative verbal instruction the test ($p<0.05$). Time spent performing the TUG test was vary on age, turning point markers, and verbal instructions. However, there was nonlinear reduction of time spent performing TUG test with increasing age in whatever conditions. The time was found the shortest in 12 years old children and the longest in 6 years old children. The results of this study revealed that the outcome of TUG test was significantly influenced by age, verbal instructions and turning point markers in typical children. Therefore, the use of TUG test in typical children should be considered about the selection of the same turning point markers, and verbal instructions in order to compare the TUG outcomes both between pre- and post-test and between age groups.

Department:	Physical Therapy	Student's Signature	.....
Field of Study:	Physical Therapy	Advisor's Signature	.....
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CHAPTER 1
INTRODUCTION

1.1 Background and rationale

The Timed Up and Go (TUG) test is one of the most popular functional mobility tests in adult population [1]. It has also been recommended for children population [2]. The TUG test was firstly developed by Mathias et al [1], in 1986, and was modified in 1991 by Podsiadlo and Richardson [3], to become the TUG test that we know today. This test includes complex motor tasks characterized by the transfer from one static posture to dynamic or bipedal posture. In TUG test, the functional mobility skills are timed and reported in seconds. The time is taken from the verbal instruction given to the participants in order to stand up from a standard arm chair. Then, the participants walk forward at a comfortable and safe pace within 3 meters distance. Lastly, the participants turn around and walk back to the chair and finally sit down[1, 4].

Currently, many studies about the TUG test offer a few modification on the test methodologies, for instance, types of the chair [5-7], the modification of test verbal instructions [7, 8], recording of the time [2, 9], the turning point markers [8], and footwear [10]. Some studies proved that these modifications have an impact and effect on TUG test scores [1, 5-8]. One of these studies was conducted by Bergmann et al [8]. This study compared 14 healthy young adults and 14 healthy elderly persons. Bergman et al [8], have found that in the young adults there was no significant difference in time whether the cone or line was used during the TUG test. However, findings on the

elderly health people showed that they had significant completion time reduction when the cone was used as a turning point marker.

Presently, the TUG test has been used extensively in children with typical or atypical development by using the similar procedure that was applied in the elderly population as well as the different procedure [2, 7, 9, 11]. The normative data and values of TUG test in children and adolescents have been reported by Nicolini-Panisson et al [12]. In their study, the procedure of the TUG test was modified for the children. Touching the target on the wall before turning was used instead of turning a cone or a line marked on the floor. This method includes visual and haptic contact input, those are important to orient the body with respect to space and also provides a reference value for anchoring posture.

In addition, there have been two instructions given by investigators to the participants, the non-qualitative and qualitative verbal instructions. The non-qualitative verbal instruction is a simple command asking participants to perform naturalistic manner of the task. While, the qualitative verbal instruction is a command with a specific demanded quality such as speed. The previous studies reported that participants did a faster TUG when given an instruction related to speed was applied [12, 13].

These modifications, turning point markers and instructions, have affected the outcome of the TUG test as reported by several studies conducted in adults. Unfortunately, there has been lack of evidence reporting the effects of different turning point markers and verbal instructions, especially in children population. Therefore, this study has aimed to investigate the effects of turning point markers and verbal instructions in typical children.

1.2 Objective of the study

To study the effects of age, turning point markers, and verbal instructions on the outcome of TUG test in typical children.

1.3 Hypothesis of the study

There would be significant interaction effects of age, turning point markers, and verbal instructions on the outcome of TUG test in typical children.

1.4 Scope of the study

The study investigated the effects of age, turning point markers and verbal instructions in typical children of age 6 to 12 years old when performing the TUG test. This study was conducted at the elementary school of Sekolah Dasar Negeri 05 in Inderalaya, South Sumatera, Indonesia.

1.5 Brief method

Typical children aged 6 to 12 years old were classified into seven groups according to their age using a match-paired method (gender). Then, all children were asked to randomly perform TUG test under six different turning point markers and verbal instruction conditions.

1.6 Advantage of the study

The results of this study would be a guideline to determine the protocol and tools for the TUG test in the children population. This information could also be utilized for developing the standard test methodology of TUG test in children population.

CHAPTER 2
LITERATURE REVIEW

2. 1 Development of gross motor function

The gross motor skills in most children have developed rapidly since birth in a head to toe order (cephalocaudal) [14]. Gross motor skills, as well as many other activities, require postural control. In general, the children with typical development learn head control and trunk stability in the early years, and then they continue learning how to stand up and walk [15].

The development of children in each stage will determine the subsequent stage of the development. Therefore, every child has to achieve through all stages of the development [14]. According to World Health Organization (WHO), six gross motor development milestones in children from birth to 5 years old have been classified including sitting without support, standing with assistance, hand and knees crawling, walking with assistance, standing without support, and walking independently [16] (see figure 2.1).

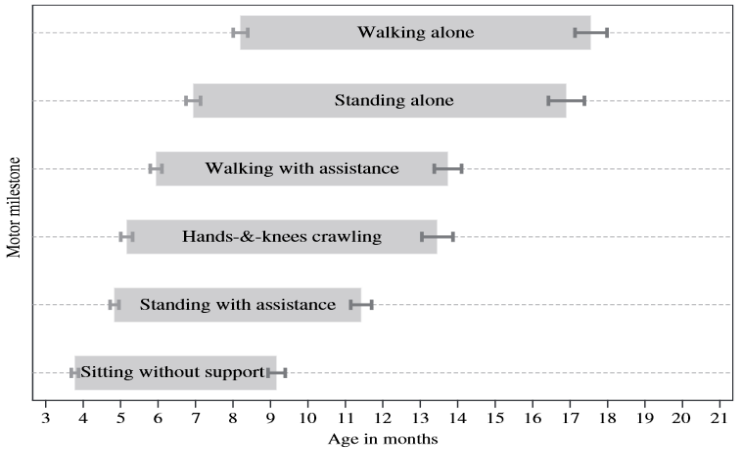

Figure 2.1 Development of Gross Motor Function in Typical Children (WHO [16])

During the first 2 years of life, the motor skills required for ordinary mobility have been developed [14]. In the next several years, the further development of higher level of gross motor skills emerges to enhance children's abilities to do more complicated and more specific tasks of daily living [17], for instance, jump in place, catch or throw a large ball, walk on a line, go up and down stairs independently, jump in different directions, hop, kick a ball, and ride a bicycle. In typically developing children, their achieved to walking independently as young as 12 months of age [18]. The adult-like gait pattern in typical children was found at about 3 years old [18, 19]. However, Haussdorff et al [20] investigated gait performance in typical children. They found that even in 7-year-old children, the ability to control stride-to-stride while walking was not fully mature.

2.2 Development of postural control

Postural control or balance is a fundamental activity of daily living. It is because many of our daily activities performed in an upright standing position. Shumway-Cook and Woollcott [4] have described postural control as "an important part and critical skill of motor development to keep the body in order to stay upright and prevent falls" [4]. In other words, postural control is the ability to keep the center of mass within the base of support and to effectively compensate when postural control is disturbed.

The postural control consists of two types namely, dynamic and static postural control. Functioning successfully in daily life requires maintenance of both static and dynamic postural control. Dynamic postural control is the ability to maintain an upright posture to move the Center of Mass (CoM) in relation to the Base of Support

(BoS) during movements, for instance, when the subject is reaching for an object or walking on establish surface [4, 13, 18]. Whereas static postural control is the ability to maintain the CoM within the BoS, for instance, being in a stationary position either standing or walking [4, 13, 18].

According to Shumway-Cook et al [4], postural control is the complex interaction between a lot of components to maintain posture from the various perturbation in dynamic or static postural control. These components include (1) musculoskeletal component; (2) Neuromuscular synergies; (3) Individual sensory system; (4) Sensory strategies; (5) Internal representation; (6) Anticipatory mechanism; and (7) Adaptive mechanism (see figure 2.2).

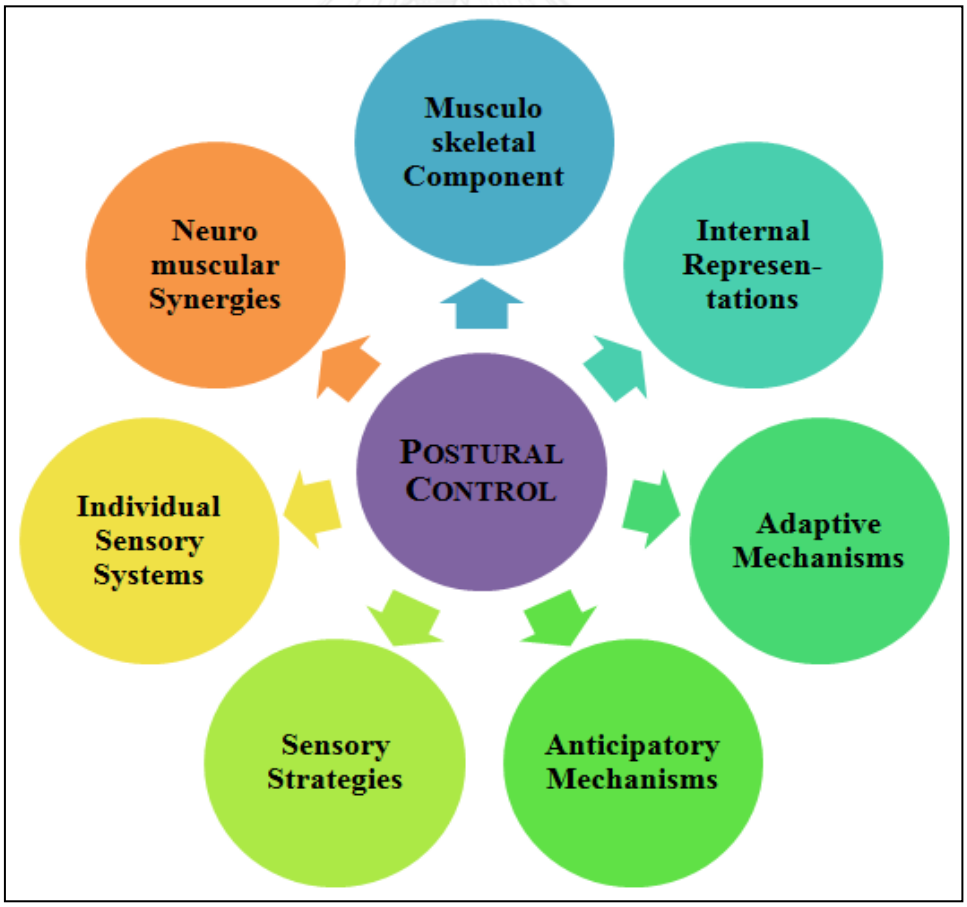

Figure 2.2 Components of Postural Control
(Shumway-Cook et al [4])

The musculoskeletal component involves skeletal alignment, the range of motions, muscle length and muscle strength. Maintaining the position of the body to remain in a proper position or without losing balance is critical for postural control [21] and is required the adjustment of the neuromuscular synergy component. It takes a very complex process to have a good ability of postural control. That requires achieved integration of information by an individual sensory system, especially from the sensory (visual, somatosensory, and vestibular), neurological and musculoskeletal systems [21].

Sensory information from visual, proprioceptive and vestibular systems contribute to postural control in terms of interpreting complex sensory environment [4]. Individual needs to be aware of any changes in the environment quickly. The internal representation is the ability of an individual to recognize and anticipate to any changes in the surrounding environment. It is important for maintaining stability when an individual moves from one static posture to dynamic or bipedal posture. The anticipatory mechanism plays an important role before performing many activities requiring the maintenance of standing posture, referring to proactive movements, such as gait initiation, gait termination, and stepping over an obstacle [4]. When an individual moves, they sometime get any unexpected perturbations from internal or external perturbations during movement. Adaptive mechanism works to ensure that the body does not fall. The body responses to any perturbation with some strategies, such as ankle strategies, hip strategies, and stepping strategies.

In the typical development children, the ability to maintain postural control in the children improves as they age due to the maturation of the systems contributing to postural control [22]. The somatosensory system matures first and then it is followed

by the vestibular system [22]. The somatosensory and vestibular systems have produced a multi-system response to maintain stability and orientation of the body's position during movements and task performances [4, 18]. To control posture, children aged around 4 months to 2 years have relied more on their visual system. Then, when they are approximately 3 to 6 years old, their ability to use the somatosensory information has been found. Eventually, children at 7 to 10 years of age demonstrate an adult-like ability to resolve a sensory conflict and also to utilize vestibular system [4, 14, 22, 23].

2.3 Factors contributing to postural control in children

There have been various factors associated with the postural control in children. The factors consist of intrinsic and extrinsic factors.

2.3.1 Intrinsic Factors

The intrinsic factors are described as something that derives from within the individual and can affect the ability of postural control. The various internal factors that effect on the postural control abilities in children are gender, age, muscle strength, and anthropometric.

2.3.1.1 Gender

Nowadays, many studies have investigated the effect of gender on postural control in children. The fundamental stages of the motor development and the abilities of motor coordination have been different between boys and girls [11]. The girls

showed a beginning of the process of development and maturity before boys [24, 25]. Previously, several studies found that girls had better performance than boys in terms of postural stability [26] and involuntary movements [27]. The girls exhibited sway significantly less than boys did [28, 29]. It would be because girls had a better use of vestibular information [24, 30, 31]. In contrast, boys have greater center of pressure (CoP) movement than girls [28]. On the other hand, some studies reported that there was no significant difference between boys and girls in terms of postural control [32-34]. Williams et al [2], reported that there was no significant difference between girls and boys aged 3 to 9 years in mean TUG scores. In general, the influence of gender on postural control is still unclear.

2.3.1.2 Age

A lot of studies have reported about age-related changes in postural control, are still debated by scientists. Several studies revealed that older children (8 to 12 years old) have demonstrated greater postural control abilities than younger children (5 to 7 years old) in TUG test performance [11, 34], and it could be seen from the time that children spent to complete the TUG task. However, Williams et al [2], revealed typical children have good performance in TUG test as young as three years old with some attention. Peterson et al [24], found that children demonstrated the use of an integration of sensory information in unperturbed stance condition like adults when children were around 12 years old. Hayes and Riach [29], assessed quiet stance in children aged 2-14 years and found that the amplitude of postural sway decreased with age.

In general, the typical children would demonstrated like adults in the anticipatory muscle activations at least at 7 years old [35] and in a response to perturbation when they have reached the age of 7-10 years old [18, 27, 29]. However, another study reported they did not demonstrate the same visual and vestibular control as adults until they were around 14 years old or older [22].

2.3.1.3 Muscle strength

Some investigators have found that the complex interactions of several factors affected the performances of postural control in children population [4, 21]. The important factor contributing to the development of motor function was muscular strength [36]. The results of a study by Wang et al [36], showed that there was a strong association between postural control and dynamic strength. Several researchers have reported that the development of sufficient muscle strength was required to control posture in order to support the body during standing and walking. In standing position, an increased activity of the antigravity postural muscles was existed to counteract the force of gravity and this was referred to as postural tone [4]. However, the effect of muscle strength was not counted in this study.

2.3.1.4 Anthropometric

Various anthropometric variables may influence postural control. Recent studies reported that anthropometry had the strongest influence on outcome measures of postural control [34, 37]. In contrast, some studies reported that there was no

correlation between height, weight, and arm length on outcome measures of postural control [11, 12].

In conclusion, from these findings, the influence that anthropometric variables may have on postural control ability in children remains unclear.

2.3.2 Extrinsic factors

The various extrinsic factors that effect on the postural control abilities in children are task constraints, socioeconomic status, and cultural issues.

2.3.2.1 Task constraints

Postural control is also dependent on task difficulty. Streepey et al [38], was measured postural control in younger children (6 years old) and older children (11 years old). They found that there were no significant differences in postural control measured by the amplitude of CoP movement with moderately difficult tasks. The other studies reported that children used larger CoP in a standing position, specifically changed from bipedal to one leg standing with open or closed their eyes [39, 40] and performed under dual task [41-43]. Some studies revealed that postural control task-dependent was difficult when they closed their eyes.

2.3.2.2 Socioeconomic status

Various factors impact on motor development and postural control abilities of children, and one of them is socioeconomic status. Yaqoob et al [44], studied psychomotor development in 1,476 infants who lived in four different areas of

Lahore. The authors found significant developmental delay in the walking ability of the infants from poorer areas. On the other hand, Capute et al [45], found an inverse relationship between socioeconomic status and motor milestones in children who were African and American. The result showed that children with higher socioeconomic status tend to have lower motor skills.

2.3.2.3 Cultural issues

Culture is an essential part of children's development process. The TUG test has been used to measure the balancing ability of children around the world. The means of TUG test scores from several countries have been reported. Australian children mean was 5.9 seconds [2], Pakistani children mean was 5.1 seconds [11], and it was 4.5 seconds for American children [34]. However, Nicolini-Panisson et al [12], was reported normative values for the TUG test of 5.6 seconds for South Brazilian children and adolescents.

However, Williams et al [2], Nicolini-Panisson et al [12], and Butz et al [34], used a modified TUG test. Whereas, Habib et al [11], followed the original protocol established by Podsiadlo and Richardson [3]. Since they used different protocols of TUG test, the comparison of their results would not be appropriate.

2.4 Assessment of postural control in children

Measurement of postural control in healthy children is very important in order to monitor their growth and identify if a child has a postural control disorder. By doing so, a physiotherapist can provide treatment and intervention as early as

possible, so that the result of therapy can be maximal. It is expected to prevent the condition of children. At present, there is various measurement of postural control that has been developed extensively for children population. The clinical measurement such as Pediatric Balance Scale (PBS), Pediatric Reach Test (PRT), and Timed Up & Go Test (TUG) are the common methods for measuring dynamic postural control. Additionally, One Leg Standing (OLS) is used for measuring static postural control.

2.4.1 Pediatric Balance Scale (PBS)

According to Franjoine et al [46]., the Pediatric Balance Scale (PBS) is approved for evaluation of postural control in children population. PBS has been modified from Berg Balance Scale (BBS) which used for assessment of the postural control ability in elderly people [47]. The PBS consists of measurement of a subject's ability to perform 14 activities from simple mobility tasks to complicated tasks, such as turning, one leg standing, and other functional activities [46]. The score for each of the 14 test items ranges from 0 to 4 points. A lower score is given if the participants are unable to do the task, and a higher score is given if the participants indicate greater balance ability and functional independence with respect to the activities of the test [46-48].

Intrarater reliability have been reported high for 20 children (aged five to 15 years old) with extremely high Intraclass Correlation Coefficient [ICC (3,1) = 0.997]. However, test-retest reliability of measurements obtained with PBS in children with mild to moderate motor impairments was extremely high [ICC (3,1) = 0.998] [46].

The PBS is easy to administer, does not require special equipment, and can be completed in less than 20 minutes [46]. However, it only measures children who have minimal to mild postural control impairments [48].

2.4.2 Pediatric Reach Test (PRT)

Duncan et al [49], developed Functional Reach Test (FRT) for adult population to access the ability to control their posture by measuring the maximal distance during reaching forward far ahead exceedingly arm's length in a standing position without taking a step or even touching the wall (see figure 2.3). In addition, Bartlett and Birmingham [50], modified FRT to make it appropriate for children population and was known as Pediatric Reach Test (PRT). The PRT was used to assess dynamic postural control by measuring the maximum distance an individual can reach forward reaching in both sitting and standing in a fixed position [50]. The PRT was reported in centimeters. The longest distances, indicated that the children have a good gross motor functional performance [49].

The test-retest and inter-rater reliability of the PRT in children with cerebral palsy was conducted by Bartlett et al [50]. The results showed that the test-retest and inter-rater reliability of the PRT were fair to good, [ICC] = 0.54-0.88 and 0.50-0.93, respectively.

Although, PRT is a very useful assessment to measure postural control ability and reaching skill in children population [51]. However, the PRT only measures one functional movement in forward direction and it does not cover all movements performed in daily activities [50].

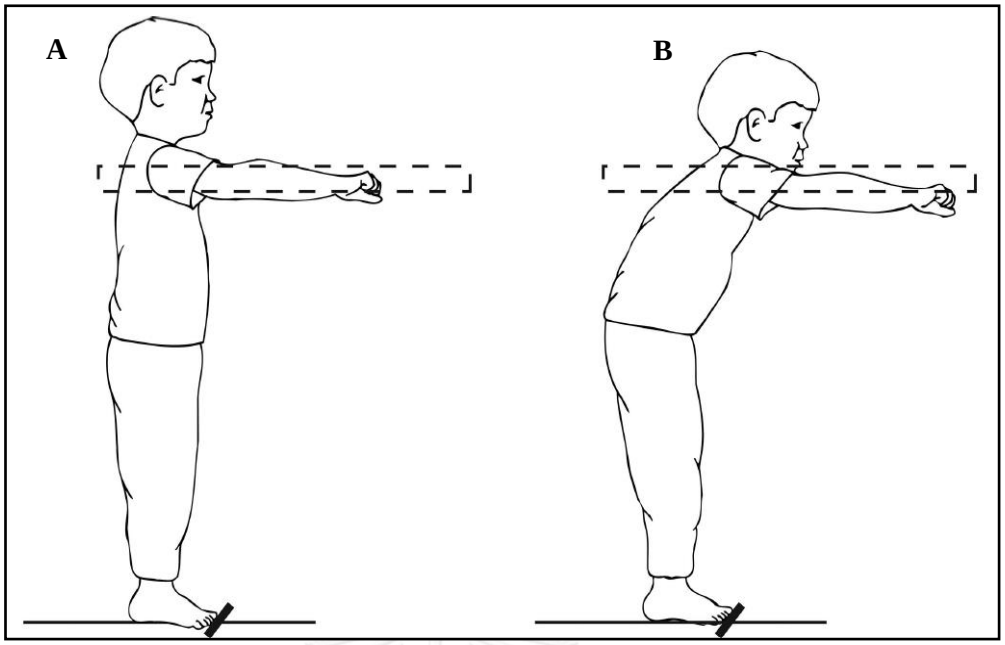

Figure 2.3 Pediatric Reach Test
A. Starting position for forward reach; **B.** End position for forward reach (Norris et al [52])

2.4.3 One Legged Stance (OLS) Test

Atwater et al [53], described the OLS test procedure with arms on the hips, eyes open and eyes closed. The children were barefoot and had to stand without assistant on one leg. For the condition of standing with eyes open, the timing was started as soon as the children lifted their foot. Moreover, in eyes closed condition the timing was recorded as soon as the children closed their eyes. Participants who were not able to perform standing on one leg for at least 5 seconds would be determined as an increased risk for fall-related injury.

The OLS test with eyes open or eyes closed showed good inter-rater reliability (Spearman's r=0.87 to 0.99) and fair to good test–retest reliability (Spearman's r=0.59 to 1.0) [53]. The OLS test is a simple test that can be completed in

about 30 seconds. The limitation of this test is the fact that it only evaluates static postural control [53, 54].

2.4.4 Timed Up and Go (TUG) Test

In 1991, Podsiadlo and Ricardson[3]., modified the Get Up and Go (GUG) test to be the Timed Up and Go (TUG) test and firstly applied it in the elderly population. TUG test has been broadly used among adult and elderly population to investigate the ability to control posture [1]. Presently, TUG test has also been used in children with typically [2, 11, 37] and atypically [2, 7, 9, 11, 37] development.

To perform the TUG test, the participants would be asked to sit on an adjustable chair with armrests and seat height between 44–47 cm [1, 3, 5, 6]. The height of the chair would be set at the level that makes the knee joint in 90 degrees of flexion when measured by a goniometer while the feet flat on the floor [2, 5, 6, 55-58]. Next, the investigator would give verbal instruction "go" to the participants, and then participants stand up and walk forward at a comfortable and safe pace to a line marked on the floor with a distance of 3 meters, then turn around and walk back to the chair and finally sit down (see figure 2.4). The length of performance time spent by the participants from standing to sitting again is recorded with a stopwatch [1, 3]. Timing begins at the instruction "go" and stops when the participants are seated [1, 3, 59]. During this test, every subject must use the same assistive device each time he/she is tested so the scores can be compared.

In children without physical disabilities, the TUG has shown good with inter-rater reliability [ICC = 0.89), within session, and (ICC = 0.83) for test-retest reliability] [2]. Dhote et al [9], reported that the reliability of TUG test was high in

thirty children with CP aged 4-12 years old, with ICC of 0.99 for within-session reliability and 0.99 for test–retest reliability. The similar idea led Katz-Leurer et al [60], to use TUG in a study of twenty-four children with traumatic brain injury and twenty-four typical development children aged 7 to 14 years old their reported that the within-session reliability for the TUG test was good [children with traumatic brain injury (ICC (1,1) = 0.86), typical development children (ICC (1,10= 0.85].

The TUG test is a reliable outcome measure in clinical settings and also known as a short and simple test to measure postural control. However, to perform the TUG test, some equipment such as chair, line on the floor and stopwatch would be needed.

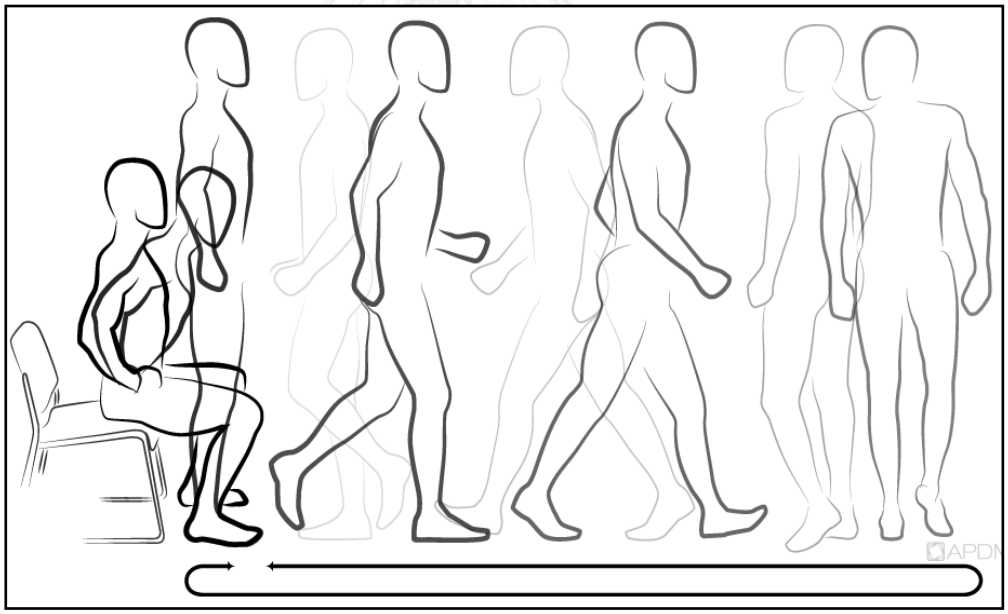

Figure 2.4 Time Up and Go Test
(http://www.apdm.com/mobility/)

In general, measuring postural control in children requires not only during performing static task but also dynamic tasks especially a task that involved an ambulation. In order to have functional independence, a mastering in postural control is required. Hence, TUG test has incorporated series of tasks wich are standing up

from a seated position, walking, turning, and sitting down. All of them are critical for independent mobility and have related to the activities in daily life.

2.5 Effects of different test methodologies on TUG test

Presently, there has been a lot of research about the TUG with a variety of test methodologies use to measure the ability to control posture in children population, for instance, the type of the chair [5-7], the test verbal instructions [7, 8], time recording [2, 9], the turning point marker [8], and footwear [10]. By using different test methodologies, this may affect the measurement outcome of the TUG test.

2.5.1 The type of the chair

To perform the TUG test, the most important equipment is a chair [1, 3, 5, 6]. However, the previous studies used different types of the chair, for instance, a standardized and non-standardized chairs, chairs with backrest and without armrest [2, 61], chairs with backrest and armrest [10, 11, 37, 62], and without backrest or armrest [7].

Previously, Lee et al [63] studied in healthy elderly adults who are taller. They were found that seat height is an important procedural factor affecting the performance of the TUG test [63]. On the other hand, some studies of the TUG test in elderly and post-stroke patients revealed that using a high chair with armrest made participants performance of standing up and sitting down easier than using a low chair without armrest as they spent less time to finish the TUG task [5, 6, 63]. However, the original test methodology recommended by Mathias and colleges [1] used an adjustable chair with backrest and armrest [2]. Unfortunately, there is no research

about this with children population as participants. In this future study, the researcher was used adjustable chair with arm and back rest.

2.5.2 Footwear

Another important thing that has to be considered in TUG test is the footwear. For practical reason, footwear is not standardized for TUG test. In consequence, a lot of studies measuring the ability of postural control with TUG test used different types of footwear. Various studies notified about what children were wearing during the TUG test, for instance, wearing regular shoes [3], without shoes [64], orthotics [7, 58, 60], and using gait assistive [2, 7, 10, 61].

However, Arnadottir et al [65], reported that the type of footwear in older women have an effect on TUG scores. The investigators found that the women moved fastest upon wearing walking shoes (with a high heels of 0 to 2 cm), slower when barefooted, and slowest when they wore dress shoes (with firm-soled, slip on shoe).

To sum up, footwear could affect a person's walking speed. The time taken to complete TUG test would be different when participants were wearing variety of shoes as well as an assistive device [66, 67]. However, no studies have examined these factors in children population. Nonetheless in this research, the researcher required the participants to wear their regular footwear with the aim that the current condition during the TUG test is the same as their daily activities.

2.5.3 Time recording

In the commonly used procedure of TUG test, timing began when the investigators said “go” [1, 3]. There are few studies in children population that use different methods. The time recording was started as soon as possible when the child left the chair rather than on the instruction “ready, go”. The time recording was stopped as soon as the child sat in the chair again [2, 9, 12]. It was aimed to only measure the time of movement. The other timing method was used in almost known studies about TUG test in adult population. The timing began when the researcher said “go”, then the participants immediately stand up from the chair [1, 3]. For children, the studies of TUG test have been performed in both timing methods.

2.5.4 Turning point markers

Mathias et al. developed the TUG test, and the first methodology in this TUG test was using line marked on the floor as a turning point marker [1]. Therefore, participants know where they are supposed to turn and walk back to the starting point [5, 55]. Nowadays, many studies were reported not only used a line marked on the floor [3, 61, 62] as a turning point marker to performance on TUG test. It has also been widely used a cone as a turning point [8].

Previously, there are some studies about TUG test in children that replaced the use of cone and line mark by asking children to touch the target on the wall before turning to ensure that participants clearly understood with the task [2, 9, 12]. This method includes visual and haptic contact input, which are important to orient the body with respect to space and also provide a reference value for anchoring posture.

However, some studies of TUG test in children still use a line mark on the floor while cone is used for measuring the TUG test in the elderly people [11, 37, 60]. With both methods, the participants will need to walk through the markers, and then turn and walk back to the chair again. In this case, the participants will take more time to finish the task. Bergmann and Colleagues [8], reported that marker layouts affected TUG test in healthy elderly people. However, it was inversely related to in healthy young adults.

According to the literature review, it is interesting to investigate what the effects of using different turning point markers on the TUG test in children population.

2.5.5 Verbal instructions

There have been some modifications of the verbal instructions that were given to the participants. The verbal instructions were given with and without qualitative speed instruction. For instance, asking the participants to walks as fast as they can [7, 11, 37], or with asking the participants to walks forward at a comfortable and safe space [2, 10, 61]. Meanwhile, several studies revealed that they gave verbal instructions repeatedly during the test [2, 11].

Based on the results of research conducted by Bergmann et al [8], the verbal instructions substantially influenced on the TUG test scores when the instructions were given regarding velocity. The researchers evaluated fourteen young adults and fourteen elderly people. They gave the qualitative instructions, "*walk as fast as they can*" and they found that the participants could reduce times to perform TUG test.

In addition, several studies in children used different verbal instructions. However, it is not known about the extent of the effects of the various given verbal instructions on TUG test scores.

2.6 Conceptual framework

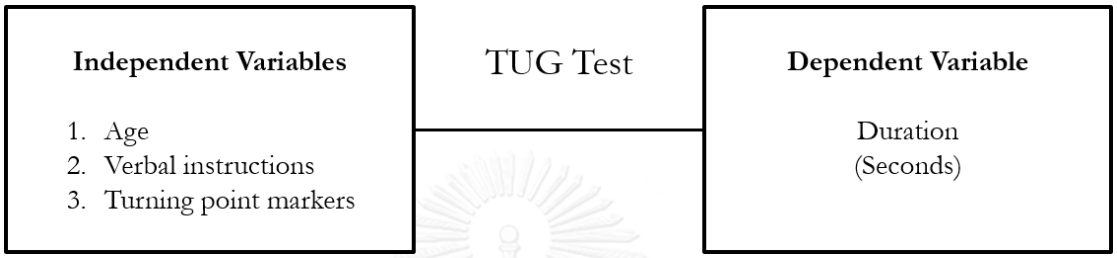

Figure 2.5 The Conceptual Framework

CHAPTER 3
MATERIALS AND METHOD

3.1 Study design

This study was an experimental study and aimed to investigate the effects of age, turning point markers and verbal instructions on the outcome of TUG test in typical children. The study protocol was approved by an ethical review committee for research involving human subject, University of Sriwijaya, Palembang, South Sumatera, Indonesia with the certificate of approval number 183/kepkrsmhfkunsri/2016 (see Appendix A).

3.2 Participants

Two hundred and ten typical children were recruited from the elementary school Sekolah Dasar Negeri 05, Inderalaya, South Sumatera, Indonesia. Participants were divided into 7 groups according to their age including 6, 7, 8, 9, 10, 11, and 12 years. Each group composed of 30 children, 15 boys and 15 girls.

All of the participants met the following inclusion criteria: (1) age between 6 to 12 years old; (2) could walk independently; (3) had appropriate age with their weight and height; and (4) could follow simple verbal instruction (such as “stand up” or “go”). Participants were excluded if they had: (1) musculoskeletal disorders, such as, limited range of motion, deformity noticeable, etc; (2) neuromuscular disorders, such as seizure, etc; (3) lower limb injury, such as ankle sprain, fracture, etc; and (4) not complete the testing.

3.3 Materials

Tools used for TUG test included an adjustable chair (Zimmple). A cone (20cm × 20cm × 40cm), a tape (20 × 2.5 cm) and a star picture (20 × 30 cm) were used as turning point markers. A digital weight balance scale machine (Kris, model EB 9321-37P-Black) was used to measure weight. A stopwatch (Yasaya, Y008) was used to time the duration of the TUG performance.

3.4 Procedure

To recruit participants, the permission for data collection in the school from the principal of the school was obtained. Then, a questionnaire and consent form were sent to the legal guardians of the students to document the students' health information. After obtaining the informed consent, the children who were healthy according to the questionnaire were randomly selected and were screened by a researcher who is a physical therapist.

Those eligible participants had both their limbs measured for the leg length. The leg length was measured from the distance between the anterosuperior iliac spines to the medial malleolus of each limb.

Each participant was asked to randomly perform the TUG test with wearing their school footwear (sneakers) in six conditions according to the instructions and the turning point markers. The instructions were non-qualitative and qualitative verbal instructions. The word, "ready, go" was used for non-qualitative verbal instruction and "walk as fast as you can, ready, go" for qualitative verbal instruction. The turning point markers were a line marked on the floor, a cone placed on the floor, and a star

picture attached on the wall three meters away from the starting point. All participants walked on a concrete floor.

A) **B)**

C)

Figure 3.1 The turning point markers
A) a line marked on the floor, B) a cone placed on the floor, C) a star picture attached on the wall.

The six conditions (2 instructions × 3 turning point markers) were as following:

Condition 1 : Non-qualitative instructions with a line marked on the floor as the end point marker.

Condition 2 : Qualitative instructions with a line marked on the floor as the end point marker.

Condition 3 : Non-qualitative instructions with a cone placed on the floor as the end point marker.

Condition 4 : Qualitative instructions with a cone placed on the floor as the end point marker.

Condition 5 : Non-qualitative instructions with a star picture attached on the wall as the end point marker.

Condition 6 : Qualitative instructions with a star picture attached on the wall as the end point marker.

To do the TUG test, firstly, participants were asked to sit on the adjustable chair with 90 degrees of knees and hip flexion, the feet flat on the floor, and their back rested on the backrest. The instructions were carried out by the researcher to the participants clearly depending on the conditions. After hearing the word "go", participants promptly stood up, walked forward for three meters to the turning point markers. Then, they turned around and walked back to the chair and sat down again. If the turning point was a star picture, participants were asked to touch the picture before turning. The time was started to record on the word "go" and stopped as soon as participants' bottom touched the seat [2, 12]. A demonstration and several trials

(maximum three trials) were provided and allowed for participants to familiarize themselves with the procedure. For each condition, the participants will do the TUG test for three times. For each trial gap there was a one-minute break. The mean from these three trials were used for the statistical analysis. The researcher who timed the duration of the TUG test demonstrating high inter-rater reliability with an Intraclass Correlation Coefficient (ICC $_{(2,2)}$ = 0.989) (see Appendix M). During data collection, a video camera was also used to capture all events.

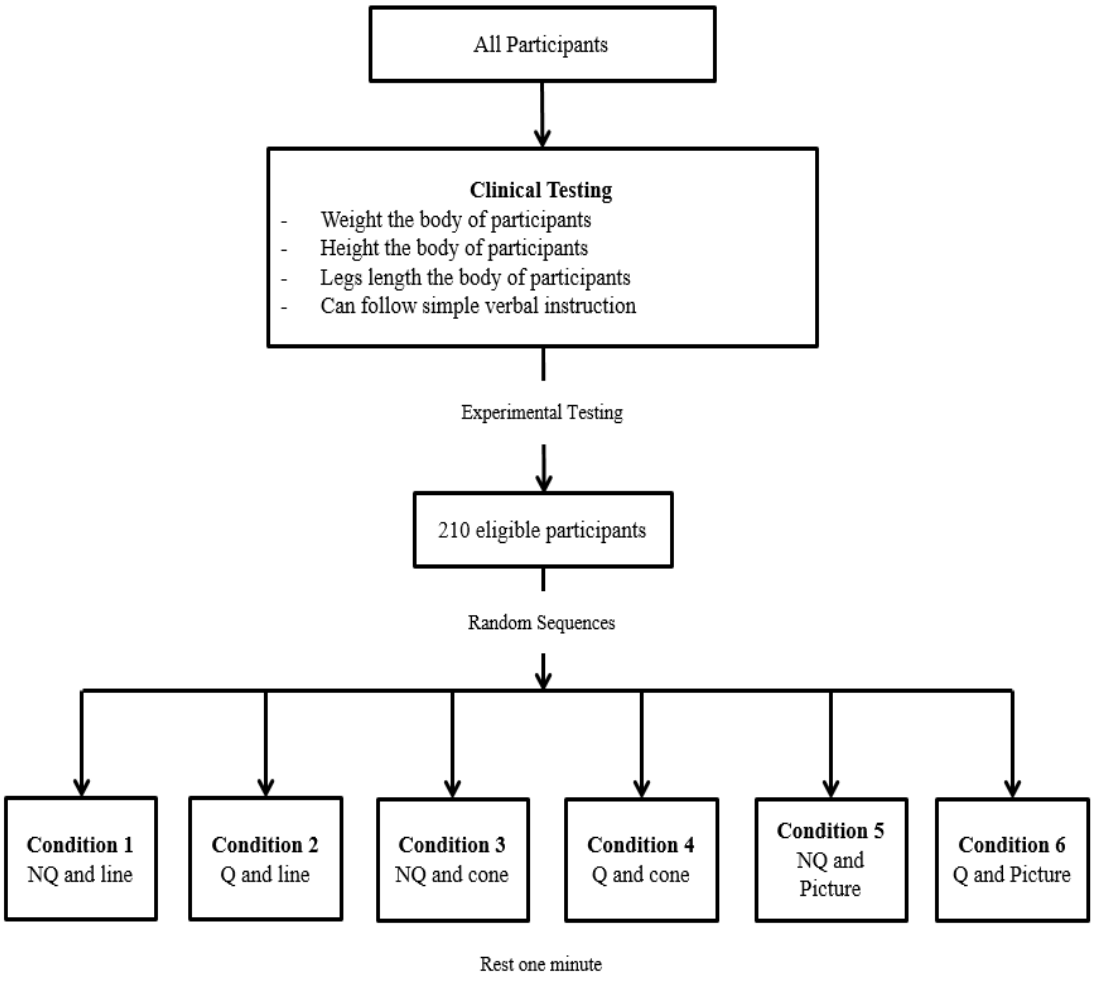

Figure 3.2 The procedure of the study

(NQ = Non-Qualitative verbal instruction, Q = Qualitative verbal instruction, Line = used line marked on the floor as a turning point marker, Cone = used cone placed on the floor as a turning point marker, Star picture = used star picture attached on the wall as a turning point marker)

3.5 Data analysis

The statistical analysis was performed by using SPSS® statistical software (IBM® SPSS® 23.0 version for windows). The Shapiro-Wilk test was used to determine the normal distribution of all data variables. In the present study, the normal distributions of the data were found. Mean and Standard Deviation (SD) were used to describe the demographic data of the participants. A three-way mixed Analysis of Variance (ANOVA) was used to examine the main and interaction effects of independent factors on TUG test; age, turning point markers and verbal instructions. Mauchly's test was performed to test the assumption of sphericity in within-subject. Pairwise comparison was carried out using Bonferroni to identify the differences of age, turning point markers and verbal instructions. The significant level deference was set at the p-value less than 0.05.

CHAPTER 4
RESULTS

This study was done to investigate the effects of age, turning point markers and verbal instructions in typical children. The results of this study were showed in this chapter.

4.1 Participant demographics data

Two hundred and ten typical children (105 girls, 105 boys), aged 6 to 12 years old participated in this study. The demographics of all participants were presented in each age group (see Table 4.1). Each age group of the participants consisted of 30 children who were 15 boys and 15 girls.

Table 4.1 Mean ± SD of the demographics of participants (n=210).

Age (n=30)	Height (cm)	Weight (kg)
6	117.86 ± 2.66	21.75 ± 1.35
7	124.03 ± 6.07	24.40 ± 3.20
8	132.62 ± 4.33	28.84 ± 2.27
9	138.21 ± 5.48	32.36 ± 3.14
10	142.07 ± 5.59	36.55 ± 6.46
11	140.91 ± 7.35	37.14 ± 4.38
12	146.05 ± 6.06	40.15 ± 8.04

4.2 Effects of age groups, turning point markers and verbal instructions on outcomes of TUG test

The three-way mixed ANOVA was used to investigate the interaction effects of seven age groups, three types of turning point markers, and two verbal instructions on the outcome of TUG test. The sphericity of within-subject was assumed. There was a significant interaction effects of group × turning point marker × verbal instruction ($F_{12,\ 406} = 0.84$, $p < 0.001$). The mean and standard deviation of the outcome of TUG test in all conditions were reported in table 4.2.

Table 4.2 Mean ± SD of Timed Up and Go test (sec) in seven age groups under 3 turning point markers and 2 verbal instructions conditions.

Age Group	Non-Qualitative Verbal Instruction			Qualitative Verbal Instruction		
	Line	Cone	Picture	Line	Cone	Picture
6	9.59 ± 0.39	9.73 ± 0.34	7.46 ± 0.36	7.13 ± 0.30	7.60 ± 0.33	6.22 ± 0.23
7	8.82 ± 0.32	9.10 ± 0.63	7.47 ± 0.46	7.11 ± 0.37	7.18 ± 0.28	6.15 ± 0.17
8	8.63 ± 0.21	8.89 ± 0.32	7.46 ± 0.63	6.83 ± 0.26	7.00 ± 0.35	6.14 ± 0.07
9	8.20 ± 0.19	8.53 ± 0.50	7.42 ± 0.37	6.82 ± 0.31	6.96 ± 0.52	6.18 ± 0.18
10	8.20 ± 0.73	8.51 ± 0.29	7.28 ± 0.58	6.67 ± 0.36	6.78 ± 0.41	5.76 ± 0.32
11	7.70 ± 0.49	7.83 ± 0.45	6.77 ± 0.38	6.33 ± 0.32	6.47 ± 0.44	5.49 ± 0.25
12	7.22 ± 0.27	7.75 ± 0.26	6.43 ± 0.29	6.03 ± 0.17	6.19 ± 0.27	5.11 ± 0.14

The post-hoc multiple comparison tests (Bonferroni) showed that the TUG time spent was no significant difference between line and cone conditions in children aged 6 and 11 years old under the non-qualitative verbal instruction and in children

aged 7 – 12 years old under the qualitative verbal instruction. In contrast, the TUG time spent was longer for the cone condition as compared to line condition in children aged 7-10 and 12 years old under the non-qualitative verbal instruction ($p<0.05$) and in children aged 6 years old under the qualitative verbal instruction ($p<0.05$). Moreover, children in every age group demonstrated the shortest time to complete TUG test in the picture condition either under non-qualitative or qualitative verbal instruction ($p<0.05$). These statements would describe in the line graphs below (see Figure 4.1).

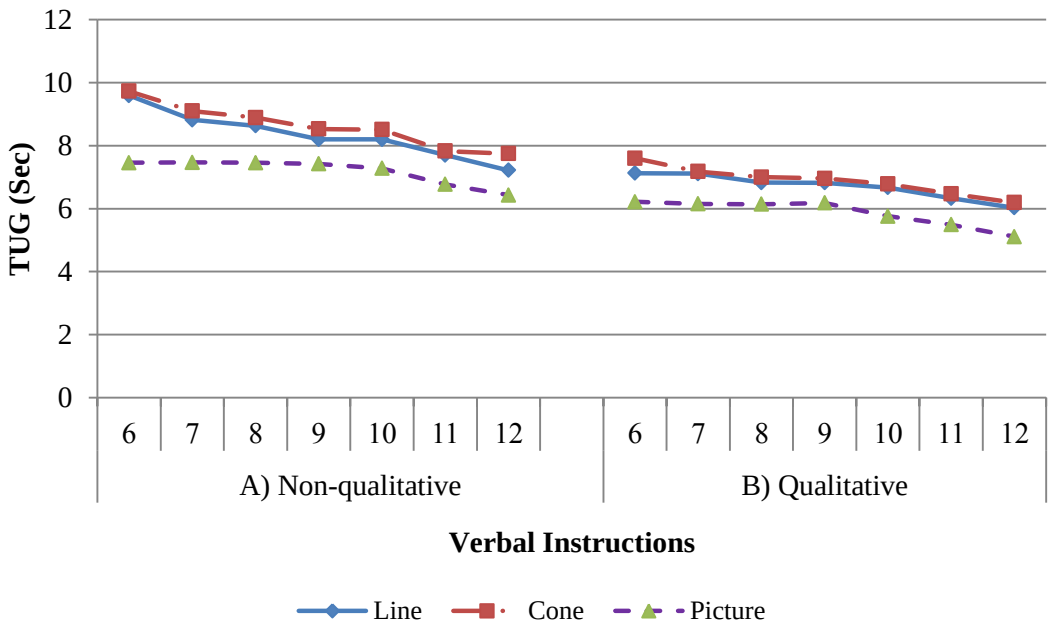

Figure 4.1 Comparison of the outcome of TUG test among three turning point markers (line, cone, and picture) in typically developing children aged 6 to 12 years. (A) Non-qualitative, and (B) qualitative verbal instructions. The data are represented as the mean ± SD (sec) at the p-value < 0.05

When age and verbal instruction were considered under different turning point marker conditions, for non-qualitative instruction, 6 years old children spent the most time to finish TUG test in line and cone conditions ($p<0.05$). The outcome of TUG test was not significant difference between 7 and 8 years old children as well as 9 and

10 years old children ($p>0.05$) in line and cone conditions. However, the outcome of TUG test was not significant difference between 11 and 12 years old children in cone, but not in line condition. In picture condition, children aged 6 – 10 years old spent more time to finish TUG test as compared to 11 and 12 years old. However, there was no significant difference of the outcome of TUG among children aged 6 – 10 years old and between 11 and 12 years old (see Figure 4.2). The results showed slightly different pattern under qualitative verbal instruction. In line condition, children aged 6 and 7 years old spent the most time to finish TUG test ($p<0.05$). Children aged 8-10 years old spent more time to finish TUG test than children aged 11 and 12 years old ($p<0.05$). Children aged 11 years old spent more time to finish TUG test than children aged 12 years old ($p<0.05$). In cone condition, 6 years old children spent the most time to finish TUG test ($p<0.05$). There was no significant difference in time to finish TUG test among 7, 8 and 9 years old children, among 8, 9 and 10 years old children, and between 11 and 12 years old children. In picture condition, there was no significant difference in time to finish TUG test among 6, 7, 8 and 9 years old children. They spent more time to finish TUG test than 10 years old children followed by 11 and 12 years old children (see Figure. 4.2).

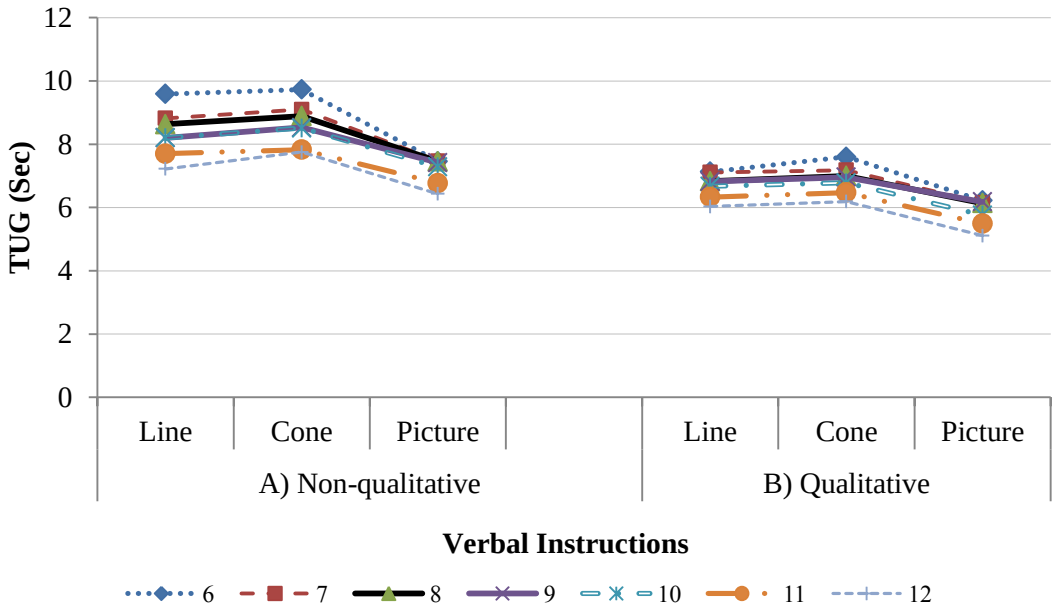

Figure 4.2 Comparison of the outcome of TUG test among seven age groups in three turning point markers (line, cone, and picture).
(A) Non-qualitative, and (B) qualitative verbal instructions. The data are represented as the mean ± SD (sec) at the p-value < 0.05.

When age and turning point marker were considered under verbal instruction conditions, children in every age group spent less time to finish TUG test under qualitative verbal instruction than under non-qualitative verbal instruction in all turning point marker conditions ($p<0.05$) (see Figure. 4.3).

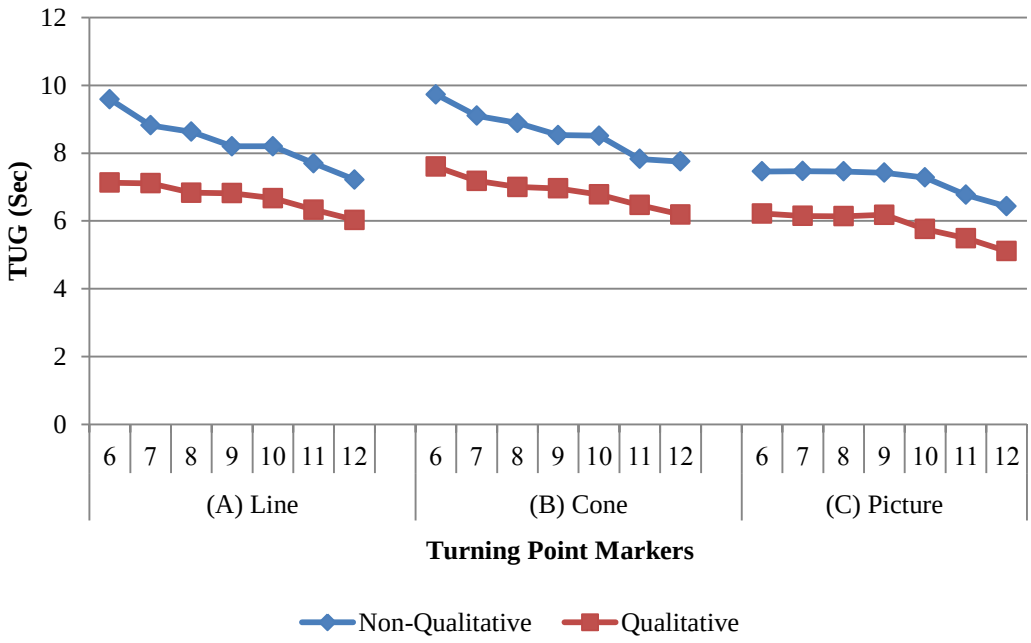

Figure 4.3 Comparison of the outcome of TUG test between non-qualitative and qualitative verbal instruction in seven age groups.
A) line, B) cone, and C) picture. The data are represented as the mean ± SD (sec) at the p-value < 0.05.

CHAPTER 5
DISCUSSION

This chapter presents a discussion of the study of the effect of age, turning point markers and verbal instructions in typical children. This includes demographics data of participants, outcomes of TUG test in the six different conditions. Furthermore, the implications of study for clinical practice, the limitations of this study, and suggestions for further study are presented respectively.

5.1 Participant demographics data

All of typical children (n=210) aged from 6 to 12 years old fulfilling the inclusion criteria agreed to participate in this study. They were divided into seven age groups. The height of children at 11 year old was lower than those 10-year-old children. There were four 11-year-old children who are very short. However, children were randomly chosen from students of elementary school. The participants were asked about their state of health according to parents' report from screening questionnaire. Participants who participated in this study had an appropriate age with their weight and height in accordance with the inclusion criteria.

5.2 Effects of age groups, turning point markers and verbal instructions on outcome of TUG test

The results of this study indicated that outcome of TUG test was significantly influenced by age of participants, verbal instructions and turning point markers. Children in every age group reduced the time to finish the TUG test in the picture as a turning point marker and qualitative verbal instruction conditions. Time spent performing the TUG test was shortest in 12 years old children. Children aged 6 years could improve their performance when applied a picture as a turning point marker with qualitative verbal instruction where as children aged 7-9 years could not.

In the picture condition, a star picture was attached on the wall 3-meter away from the starting point, participants mostly reach out to touch a picture before finishing 3-meter walking. Therefore, participants certainly walked shorter than 3 meters in a picture condition as compared to the other conditions. In contrast, in the line and the cone conditions, participants had to walk beyond 3-meter in order to turned around. Additionally, the video recording showed that most participants in this study made a sharp turn after they touched a picture. Additionally, when children were asked to performance of TUG test used a picture attached on the wall consisting touched the target on the wall before turning this method include haptic contact inputs, also provide a reference value for anchoring posture [68, 69]. In a cone condition, participants spent more time to finish TUG because they walked a little bit far away from a cone to make a turn. However, the process of turning by using a line or cone consists of decelerating the forward motion, rotating the body, passed walking 3-meter away without hitting the turning point and stepping out toward the new direction. According to Hase and Stein [70], when adults made a turn while walking,

the position of the front leg would be used as an axial leg before rotating the body and then made some steps to turn back.

Moreover, this study demonstrated that the qualitative verbal instruction could improve motor functional ability. The instruction that indicated the quality demand may have an intension to increase an individual attention and motivation to accomplish the task [71]. Therefore, shorter distance, sharp turning and motivation simultaneously could reduce time spent to performing TUG test in children of all age groups.

Another important issue to be taken into account was age. The results of this study indicated that the outcome of TUG test non-linearly improved with age depending on turning point marker and verbal instruction conditions. When a picture as a turning point marker with qualitative verbal instruction was applied in TUG test, children aged 6 years could improve their performance where as children aged 7-9 years could not. However, it was obvious that 12 years old children performed the fastest TUG. Age was reported as a significant factor for typically developing children in performing TUG test [2, 28, 31, 60]. Independent walking is a highly complex series of actions. Nevertheless, this skill can be learned through practice [72]. The older children could perform TUG faster than the younger children as the older children stepped longer [75], walked faster and became more skilled walkers [2, 28, 31, 60], according to an increase in their muscle strength [30], weight and height [31], adaptations to sensory conditions improve [4], and improvement of motor coordination and postural control [73-75]. However, children 7 – 9 years old did not showed different improvement of TUG in a picture as a turning point marker with qualitative verbal instruction condition since they have been categorized in the same group according to

the stage of physical development [76] as well as the sensory processing [22, 24]. In the line and cone conditions under either non-qualitative or qualitative verbal instruction, the older children did not always spent shorter time to finish TUG test than the younger children. This may because children aged 6 – 12 years are still in developing the process of postural control. The previous study reported that postural control was still developing after 9 to 10 years of age [28].

5.3 The implications of the study for clinical practice

The results of this study showed that the outcome of TUG test in typical children could be change if the turning point markers and verbal instructions were changed. Hence, the assessors using TUG test should concern of interpretation the outcome of TUG test that obtain from the difference tools and instruction. They should also consider applying the same tool and instruction to perform TUG test. Therefore, clinicians should consider using the same turning point marker and instruction when performing test-retest of TUG test in children with diagnosed such as cerebral palsy, Down syndrome, brain injury etc.

5.4 The limitations of the study and the suggestions for further study

The results of this study should be interpreted with caution because of a few limitations. First, the characteristics of the participants in this study were typical children. Second, this study was conducted in 6 to 12 years old children. It would be limited to generalize the result to all ages of the children. For further study, the

investigation of these effects in children with other conditions, for instance, children with cerebral palsy, and Down syndrome should be conducted.

CHAPTER 6
CONCLUSION

In conclusion, the results of this study revealed that there was significant interaction effect of age, turning point markers, and verbal instructions on the outcome of TUG test in typical children. Therefore, the use of TUG test in atypical children should be considered about the selection of the same turning point markers, and verbal instructions in order to compare the TUG outcomes both between pre- and post-test and between age groups. In addition, the interpretation of the TUG outcomes should be done with caution especially when the outcomes were obtained from the different tools and instructions.

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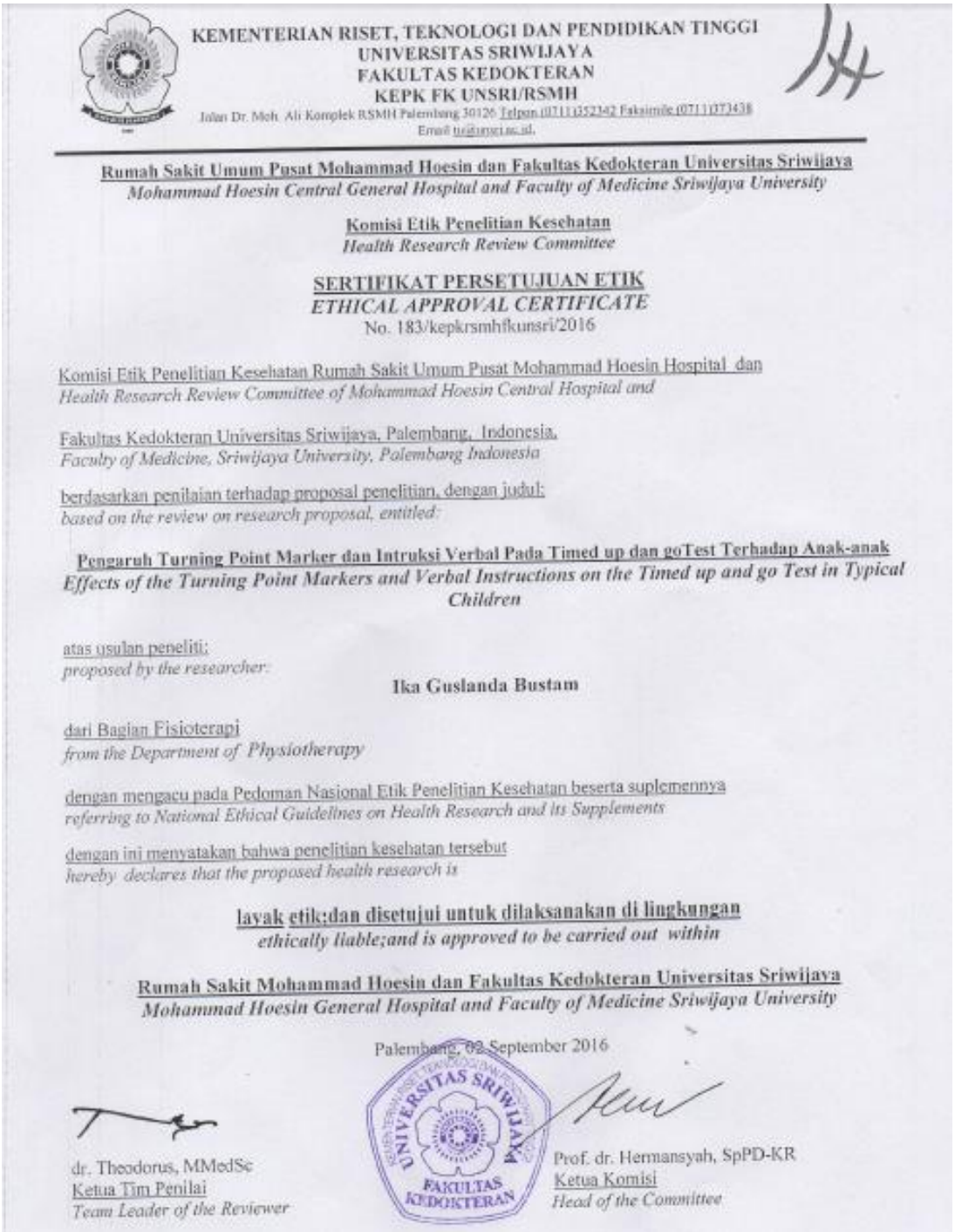
APPENDIX

APPENDIX A
ETHICAL CERTIFICATED

The study protocol was approved by ethical review committee for research involving human subject, University of Sriwijaya, Palembang, South Sumatera, Indonesia.



KEMENTERIAN RISET, TEKNOLOGI DAN PENDIDIKAN TINGGI
UNIVERSITAS SRIWIJAYA
FAKULTAS KEDOKTERAN
KEPK FK UNSRI/RSMH
Jalan Dr. Moh. Ali Komplek RSMH Palembang 30126 Telpon (0711) 352342 Faksimile (0711) 373438
Email: ...

Rumah Sakit Umum Pusat Mohammad Hoesin dan Fakultas Kedokteran Universitas Sriwijaya
Mohammad Hoesin Central General Hospital and Faculty of Medicine Sriwijaya University

Komisi Etik Penelitian Kesehatan
Health Research Review Committee

SERTIFIKAT PERSETUJUAN ETIK
ETHICAL APPROVAL CERTIFICATE
No. 183/kepkrsmhfkunsri/2016

Komisi Etik Penelitian Kesehatan Rumah Sakit Umum Pusat Mohammad Hoesin Hospital dan
Health Research Review Committee of Mohammad Hoesin Central Hospital and

Fakultas Kedokteran Universitas Sriwijaya, Palembang, Indonesia,
Faculty of Medicine, Sriwijaya University, Palembang Indonesia

berdasarkan penilaian terhadap proposal penelitian, dengan judul:
based on the review on research proposal, entitled:

Pengaruh Turning Point Marker dan Intruksi Verbal Pada Timed up dan goTest Terhadap Anak-anak
Effects of the Turning Point Markers and Verbal Instructions on the Timed up and go Test in Typical Children

atas usulan peneliti:
proposed by the researcher:

Ika Guslanda Bustam

dari Bagian Fisioterapi
from the Department of Physiotherapy

dengan mengacu pada Pedoman Nasional Etik Penelitian Kesehatan beserta suplemennya
referring to National Ethical Guidelines on Health Research and its Supplements

dengan ini menyatakan bahwa penelitian kesehatan tersebut
hereby declares that the proposed health research is

layak etik;dan disetujui untuk dilaksanakan di lingkungan
ethically liable;and is approved to be carried out within

Rumah Sakit Mohammad Hoesin dan Fakultas Kedokteran Universitas Sriwijaya
Mohammad Hoesin General Hospital and Faculty of Medicine Sriwijaya University

Palembang, 02 September 2016

dr. Theodorus, MMedSc
Ketua Tim Penilai
Team Leader of the Reviewer

UNIVERSITAS SRIWIJAYA FAKULTAS KEDOKTERAN

Prof. dr. Hermansyah, SpPD-KR
Ketua Komisi
Head of the Committee

Composition of Ethics Committee:

KEMENTERIAN RISET, TEKNOLOGI DAN PENDIDIKAN TINGGI
UNIVERSITAS SRIWIJAYA
FAKULTAS KEDOKTERAN
KEPK FK UNSRI/RSMH
Jalan Dr. Moh. Ali Komplek RSMH Palembang 30126 Telpon (0711)352342 Faksimile (0711)373438
Email tu@unsri.ac.id,

THE LIST OF MEMBERS

HEALTH RESEARCH ETHICAL COMMITTEE
MOH. HOESIN HOSPITAL
Palembang, South Sumatra
0711-373438
September 02, 2016

Composition of Ethics Committee :

No	Name	Position	Gender M/F	Department	Signature
1	Prof. dr. Hermansyah. SpPD-KR, FINASIM, CCD	Head of the Committee KEPK	Male	Internist Medicine	
2	Prof. Dr. dr. Yuwono, M. Biomed	Chairman	Male	Microbiology	
3	dr. Mutiara Budi Azhar, SU, MMedSc	Examiner	Male	Anathomy	
4	dr. Theodorus, MMeSc	Examiner	Male	Pharmacology	
5	dr. Kemas Ya'kub Rahadiyanto, SpPk, M.Kes	Examiner	Male	Pathology clinic	

"The Health Research Ethical Committee of Moh. Hoesin Hospital with regards of the protection of human rights and welfare in medical research is organized and operates according to ICH GCP guidelines and applicable laws and regulations"

Acknowledged by:

Prof. dr. Hermansyah. SpPD-KR, FINASIM, CCD
Chairman of the Committee KEPK

APPENDIX B

SCREENING QUESTIONNAIRE (INDONESIA VERSION)

Tanggal: 8 September 2016

A. Biodata Anak

1. No. Partisipan : 026 A (diisi oleh peneliti)
2. Tanggal Lahir : 12/11/2010
3. Usia : 6 tahun
4. Jenis Kelamin : ☐ Laki-laki ☑ Perempuan
5. Tinggi Badan : 118 cm
6. Berat Badan : 23,7 kg

B. Pertanyaan untuk Orang Tua

1. Apakah anak anda di diagnosa memiliki kelainan fisik atau kecacatan, jelaskan:
   tidak
2. Apakah baru-baru ini anak anda mendapatkan penanganan pengobatan?
   ☐ Iya ☑ Tidak
   Jika iya, jelaskan:
3. Apakah anak anda memiliki riwayat kejang-kejang?
   ☐ Iya ☑ Tidak
4. Apakah anak anda memiliki atau mengeluh nyeri pada tungkai bawah/kaki?
   ☐ Iya ☑ Tidak
5. Apakah anak anda mengalami cidera pada tungkai bawah/kakinya, (seperti fraktur misalnya) pada 6 bulan terakhir?
   ☐ Iya ☑ Tidak
6. Apakah anak anda dalam proses pengobatan pada tungkai bawah/kakinya, (seperti fraktur misalnya) pada 6 bulan terakhir?
   ☐ Iya ☑ Tidak

APPENDIX C

SCREENING QUESTIONNAIRE (ENGLISH VERSION)

Date: .....

A. Personal Data of Your Child

1. No. Participant : ..... (filled by investigator)
2. Date of Birth : .....
3. Age : ..... years old
4. Gender : ☐ Boy ☐ Girl
5. Height : ..... cm
6. Weight : ..... kg

B. Parents Questionnaire **Study of TUG Test in Children Population**

1. If your children has been identified with a specific medical diagnosis, (i.e. deformity noticeable, etc.) please list below:
   .....
   .....
   .....

2. Does your child currently taking any medication?
   ☐ Yes ☐ No
   If yes, please list below:
   .....
   .....
   .....

3. Does your child have a history of seizures?
   ☐ Yes ☐ No

4. Does your child have pain in their lower limbs?
   ☐ Yes ☐ No

5. Does your child have an injury in their lower limbs, i.e fracture in the past 6 months?
   ☐ Yes ☐ No

6. Is your child undergoing any treatment on their lower limbs in the past 6 months?
   ☐ Yes ☐ No

APPENDIX D
PARTICIPANTS INFORMATION SHEET (INDONESIA VERSION)

Judul Penelitian: Pengaruh Turning Point Markers dan Verbal Instructions terhadap Timed Up and Go Test pada Typical Children

Nama Ketua Peneliti Ms. Ika Guslanda Bustam **Posisi** Mahasiswa Master

Alamat Kampus Department of Physical Therapy, Faculty of Allied Health Sciences, Chulalongkorn University. 154 University Rd., Rama 1 Road, Pathumwan, Bangkok palace, 10330.

Alamat Rumah 1) Chulalongkorn University International House (CU I-House) 268 Chulalongkorn Soi9, Charasmuang road, Wangmai, Pathumwan, Bangkok, Thailand

2) Taman Permata Indah Blok D VIII, No 18 Inderalaya, Ogan Ilir, Sumatera Selatan, 30662

Telepon (Kampus) +6622183766

Telepon +66955060652 (Thailand), +6285268924321 (Indonesia)

E-mail: ika.g@student.chula.ac.th

1. Anak Anda diundang untuk berpartisipasi dalam proyek penelitian. Sebelum Anda dan anak Anda memutuskan untuk berpartisipasi penting bagi Anda dan anak Anda untuk memahami mengenai penelitian yang akan dilakukan dan apa saja yang akan terlibat. Luangkan waktu untuk membaca informasi berikut dengan hati-hati dan jangan ragu untuk bertanya jika ada sesuatu yang tidak jelas atau jika Anda ingin informasi lebih lanjut.

2. Penelitian ini akan meneliti tentang pengaruh dari turning point marker and verbal instruction on the Timed Up and Go (TUG) pada anak-anak.
3. Detail partisipan:

   Partisipan akan terdiri dari sebanyak 210 anak-anak yang merupakan siswa dan siswi dari Sekolah Dasar Negeri 05 Inderalaya. Mereka akan menjadi partisipan jika memenuhi syarat sebagai berikut: (i) Berusia 6 hingga 12 tahun; (ii) Mampu berjalan dengan baik; (iii)Memiliki berat badan dan tinggi badan yang sesuai dengan usia mereka; (iv) Mampu mengikuti instruksi seperti "berdiri" dan "go". Partisipan akan ditolak jika memiliki: (i) Gangguan musculoskeletal, seperti, terbatas ruang gerak sendi, kecacatan, dll; (ii) Gangguan neuromuscular, seperti, kejang-kejang, dll; (iii) Cidera tungkai bawah, seperti ankle sprain, fraktur, dll; (iv) Tidak mampu menyelesaikan tes Timed Up and Go.
4. Prosedur terhadap partisipan:

   Anak anda akan dilakukan pemeriksaan oleh Fisioterapis untuk memastikan anak anada masuk dalam kriteria pada penelitian ini.

   Jika mereka memenuhi kriteria selanjutnya mereka akan diminta untuk duduk di kursi yang telah disediakan dengan posisi lutut dan pinggul 90°, kaki menyentuh lantai dan bersender pada kursi ketika duduk. Kemudian, saya akan memberikan instruksi kepada anak anda untuk berjalan sejauh 3 meter, kemudian berputar pada titik yang telah ditentukan selanjutnya berjalan kembali menuju kursi dan duduk kembali. Waktu yang mereka gunakan selama melakukan hal tersebut akan direkam dengan menggunakan stopwatch. Kegiatan ini terdiri dari 6 kondisi yang menggunakan titik balik yang berbeda seperti garis di lantai, kerucut maupun stiker di dinding, dan instruksi seperti "siap, go" atau "berjalan secepat yang kamu bisa, siap, go", masing-masing kondisi akan di ulang sebanyak 3 kali. Penelitian ini akan berlangsung kurang lebih selama setengah jam. Disetiap sesi akan terdapat 1 menit istirahat. Semua data anak anda akan dirahasiakan.
5. Segala informasi mengenai penelitian ini akan disampaikan kepada Anda dan anak Anda oleh peneliti. Jika Anda dan anak Anda menyetujui untuk

berpartisipasi pada penelitian ini, Anda dan anak Anda akan dimintai untuk menandatangani formulir persetujuan yang telah disediakan.

6. Jika dalam proses tes skrening terhadap calon peserta, ditemukan seorang anak tidak memenuhi kriteria inklusi dan membutuhkan bantuan / saran, peneliti akan memberikan saran dan / atau perawatan mendasar untuk meningkatkan / kemampuannya.
7. Dengan mengikuti penelitian ini, anak anda tidak akan mengalami resiko apapun.
8. **Manfaat** dari penelitian ini antara lain, tes TUG merupakan tes yang cepat, tes ini banyak digunakan pada klinikal untuk mengukur kemampuan fungsional bergerak. Selanjutnya, anak anda akan mendapatkan pemeriksaan fungsional terutama kemampuan berjalan. Anda akan mendapatkan laporan dari peneliti ketika pemeriksaan telah selesai. Selain itu, tujuan dari penelitian ini adalah untuk mengetahui pengaruh turning point marker dan instruksi lisan pada tes TUG. Oleh karena itu, hasil dari penelitian ini akan menjadi pedoman pedoman untuk terapis dalam menentukan penggunaan turning point marker dan instruksi lisan untuk tes TUG pada populasi anak-anak. Informasi ini juga dapat dimanfaatkan untuk mengembangkan tes TUG metodologi tes standar dalam populasi anak.
9. Partisipasi penelitian ini bersifat **sukarela** dan anak Anda memiliki hak untuk **menolak dan / atau menarik diri** dari penelitian setiap saat, tidak perlu memberikan alasan, dan tidak **akan ada dampak buruk** pada anak Anda.
10. Informasi yang berhubungan langsung dengan anak Anda akan **dirahasiakan**. Hasil dari penelitian ini akan dilaporkan sebagai grafik. Setiap informasi yang bisa dapat mengidentifikasi anak Anda tidak akan muncul dalam laporan
11. Anak anda akan mendapatkan snack berupa minuman dan makanan ringan, selain itu juga mendapatkan sovenir berupa alat tulis sebagai rasa terimakasih peneliti karena anak anda telah berpartisipasi pada penelitian ini.

12. Jika peneliti tidak melakukan seperti apa yang telah disampaikan dalam lembar informasi, anda dapat melaporkan hal tersebut pada Komisi Etik Penelitian Kesehatan, Universitas Sriwijaya, Palembang, Sumatera Selatan, Indonesia. jalan Dr. Moh. Ali komplek RSMH Palembang 30126, Sumatera Selatan, Indonesia. Tel./Fax. +62711 352 342 / +62711 373 438, E-mail: tu@unsri.ac.id

APPENDIX E
PARTICIPANTS INFORMATION SHEET (ENGLISH VERSION)

Title of research project: Effects of the Turning Point Markers and Verbal Instructions on the Timed Up and Go Test in Typical Children

Principle researcher's name Ms. Ika Guslanda Bustam **Position** Master's student

Office address Department of Physical Therapy, Faculty of Allied Health Sciences, Chulalongkorn University, 154 University Rd., Rama 1 Road, Pathumwan, Bangkok palace, 10330.

Home address 1) Chulalongkorn University International House (CU I-House) 268 Chulalongkorn Soi9, Charasmuang road, Wangmai, Pathumwan, Bangkok, Thailand
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Telephone (office) +6622183766

Cell phone +66955060652 (Thailand)
+6285268924321 (Indonesia)

E-mail: ika.g@student.chula.ac.th

1. Your child is being invited to take part in a research project. Before you and your child decide to participate it is important for you and your child to understand why the research is being done and what it will involve. Please take time to read the following information carefully and do not hesitate to ask if anything is unclear or if you would like more information.
2. This research project involves the investigating of the effects of the turning point marker and verbal instruction on the Timed Up and Go (TUG) Test in typical children.

3. Details of participants:

   Participants will be 210 typical development children who agree to participate in this study. They will be recruited from the elementary schools in Indonesia. Participants will be eligible for this study if they meet the following inclusion criteria; (i) age between 6 to 12 years old; (ii) can walk independently; (iii) have appropriate age with their weight and height; and (iv) can follow simple verbal instruction such as “stand up” or “go”. Participants will be excluded if they have: (i) musculoskeletal disorders, such as, limited range of motion, deformity noticeable, etc,; (ii) neuromuscular disorders, such as seizure, etc.; (iii) lower limb injury, such as ankle sprain, fracture, etc.; and (iv) do not complete the testing.

4. Procedure upon participants:

   Your child will be screened by a physical therapist to see if your child meets the inclusion criteria of the study. If he/she meets all inclusion criteria, he/she will be asked to sit on the adjustable arm chair with his/her knee and hip both flexed at 90 degrees, feet flat on the floor and back contacted to the backrest. Then, your child will be asked to walk 3 meters forward to the turning point marker, then, turn around and walk back to sit down on the chair at a comfortable and safe pace. The time spent to perform this task will be recorded by a stopwatch. Your child will be asked to perform this task several times to get 3 complete trials in 6 conditions with different turning point like a tape, a cone, a star, and instructions such as “ready, go” and “walk as fast as you can, ready, go”. There will be 1-minute break for each condition. This will take approximately a half an hour to finish the test. All personal data of your child will be kept confidential.

5. The information of the study will be provided to you and your child by a researcher. If you and your child agree to participate in the study, you and your child both sign on the informed consent form.

6. If the process of **screening** potential participant found a child not meet inclusion criteria and in need of help/advice, researcher will give an advice and/or a fundamental treatment to improve his/her ability.

7. By participating in this study, your child will not have any risk.
8. For **benefit** of this study, the TUG test is a quick test, used in clinical practice as an outcome measure to assess functional ambulatory mobility or dynamic postural control. Therefore, your child will get an assessment of functional ambulatory mobility, especially walking. You will receive a report from a researcher when the test is finished. In addition, the purpose of this study is to determine the effect of the turning point markers and the verbal instructions on TUG test. Hence, the results of this study will be guidelines for therapists in determining the use of the turning point markers and the verbal instructions for the TUG test in the children population. This information could also be utilized for developing the standard test methodology TUG test in pediatric population.
9. Participation to the study is **voluntary** and your child has the **right to deny** and/or **withdraw** from the study at any time, no need to give any reason, and there will be no bad impact upon your child.
10. Information related directly to your child will be kept **confidential.** Results of the study will be reported as total picture. Any information which could be able to identify your child will not appear in the report.
11. Your child will get a souvenir such as Stationary (e.g drawing book, book, pencil, and crayon) for participating in this study.
12. If researcher does not perform upon your child as indicated in the information, you can report the incident to the Ethical Review Committee for Research Involving Human Subject, University of Sriwijaya, Palembang, South Sumatera, Indonesia. The Ethical Review Committee for Research Involving Human Subject, University of Sriwijaya, Road Dr. Moh. Ali komplek RSMH Palembang 30126, South Sumatera, Indonesia. Tel./Fax. +62711 352 342 / +62711 373 438, E-mail: tu@unsri.ac.id

APPENDIX F

INFORMED CONSENT FORM (INDONESIA VERSION)

Alamat ……..……

Tanggal ……..……

No. Partisipan …… (diisi oleh peneliti)

Saya yang bertandatangan dibawah ini adalah (Bapak/Ibu/Wali) dari (nama partisipan) …..... menyetujui untuk berpartisipasi dalam penelitian dengan **Judul:** "Effects of the Turning Point Markers and Verbal Instructions on the TImed Up and Go Test in Typical Children"

Ketua Peneliti: Nn. Ika Guslanda Bustam

Alamat:

Alamat Kampus : Department of Physical Therapy, Faculty of Allied Health Sciences, Chulalongkorn University. 154 University Rd., Rama 1 Road, Pathumwan, Bangkok palace, 10330.

Alamat Rumah : Taman Permata Indah Blok D VIII, No 18 Inderalaya, Ogan Ilir, Sumatera Selatan, 30662

Telepon (Kampus) : +6622183766

HP : (Thailand) +66955060652, (Indonesia) +6285268924321

E-mail : ika.g@student.chula.ac.th

Saya sebagai wali dari partisipan telah informasikan mengenai apa yang akan dilakukan terhadap partisipan, resiko/bahaya dan manfaat dari penelitian ini. Saya juga telah membaca rincian di lembar informasi dan **memahami dengan sangat jelas.**

Saya menyetujui anak/wali saya untuk mengikuti penelitian ini sebagai partisipan dan dilakukan tes skrining terhadapnya dan melakukan tes Timed Up and Go. Anak/wali saya akan duduk di kursi yang telah disediakan dengan posisi lutut dan pinggul 90°, kaki menyentuh lantai dan bersender pada kursi ketika duduk. Kemudian, instruksi akan diberikan oleh peneliti kepada anak/wali saya untuk berjalan sejauh 3 meter, kemudian berputar pada titik yang telah ditentukan selanjutnya berjalan kembali menuju kursi dan duduk kembali. Waktu yang mereka gunakan selama melakukan hal tersebut akan direkam dengan menggunakan stopwatch. Kegiatan ini terdiri dari 6 kondisi yang menggunakan titik balik yang berbeda seperti garis di lantai, kerucut maupun stiker di dinding, dan instruksi seperti "siap, go" atau "berjalan secepat yang kamu bisa, siap, go", masing-masing kondisi akan di ulang sebanyak 3 kali. Penelitian ini akan berlangsung kurang lebih selama setengah jam.

Baik saya maupun anak/wali saya berhak untuk **menolak dan tidak melanjutkan** kembali sebagai partisipan tanpa perlu memberikan alasan. Penolakan ini **tidak akan memberikan efek yang negatif** terhadap saya maupun pada anak/wali saya.

Peneliti telah menjamin bahwa prosedur yang akan dilakukan pada anak/wali saya akan sesuai dengan apa yang ditunjukkan dalam informasi. Setiap informasi pribadi dari anak/wali saya **akan dirahasiakan**. Hasil dari penelitian ini akan dilaporkan dengan grafik maupun gambar. Setiap informasi pribadi yang bisa dapat mengidentifikasi anak/wali saya dan diri saya tidak akan muncul dalam laporan.

Jika anak/wali saya tidak diperlakukan seperti apa yang telah disampaikan dalam lembar informasi, saya bisa melaporkan kepada Komisi Etik Penelitian Kesehatan, Universitas Sriwijaya, Palembang, Sumatera Selatan, Indonesia. jalan Dr. Moh. Ali komplek RSMH Palembang 30126, Sumatera Selatan, Indonesia. Tel./Fax. +62711 352 342 / +62711 373 438, E-mail: tu@unsri.ac.id

Saya juga telah menerima **salinan lembar informasi dan formulir kesedian.**

Tanda tangan …….....……

(Nn. Ika Guslanda Bustam)

Peneliti

Tanda tangan …….....……

(……..……)

Partisipan

Tanda tangan …….....……

(……..……)

Orang tua / Wali Partisipant

Tanda tangan …….....……

(……..……)

APPENDIX G

INFORMED CONSENT FORM (ENGLISH VERSION)

Address ……

Date ……..

Code number of participant …… (Filled by researcher)

I who have signed here below is (indicate: father/mother/legal guardian) of (name of participant) …..... agree to participate in this research project **Title:** "Effects of the Turning Point Markers and Verbal Instructions on the Timed Up and Go Test in Typical Children"

Principle researcher's name: Ms. Ika Guslanda Bustam

Contact address:

Office address: Department of Physical Therapy, Faculty of Allied Health Sciences, Chulalongkorn University. 154 University Rd., Rama 1 Road, Pathumwan, Bangkok palace, 10330.

Home address: Taman Permata Indah Blok D VIII, No 18 Inderalaya, Ogan Ilir, South Sumatera, Indonesia, 30662

Telephone (office) +6622183766

Cell phone +66955060652 (Thailand),
+6285268924321 (Indonesia)

E-mail: ika.g@student.chula.ac.th

I and person under my care have been informed about rational and objective(s) of the project, and what will be done in details upon the person under my care, risk/harm and benefit of this project. I have read details in the information sheet and **clearly understand with satisfaction.**

I willingly **agree** to let the person under my care participate in this project and consent the researcher to do screening test and the Timed Up and Go test. The person under my care will be asked to sit on the adjustable arm chair with his/her knee and hip both flexed at 90 degrees, feet flat on the floor and back contacted to the backrest. Then, he/she will be asked to walk 3 meters forward to the turning point marker, then,

turn around and walk back to sit down on the chair at a comfortable and safe pace. The time spent to perform this task will be recorded by a stopwatch. This task will be performed several times to get 3 complete trials in 6 conditions with different turning point like a tape, a cone, a star, and instructions such as “ready, go” and “walk as fast as you can, ready, go”. There will be 1-minute break for each condition. This will take approximately a half an hour to finish the test.

Either the person under my care or I have **the right** to withdraw from this research project at any time as wished, with no need **to give any reason**. This withdrawal **will not have any negative impact upon person under my care or me (e.g.: receive the same usual services).**

Researcher has guaranteed that procedure(s) which will be acted upon the person under my care would be exactly the same as indicated in the information. Any personal information of person under my care will be **kept confidential.** Results of the study will be reported as total picture. Any personal information which could be able to identify person under my care and myself will not appear in the report.

If the person under my care **is not treated as indicated in the information sheet**, I can report to the Ethical Review Committee for Research Involving Human Subject, University of Sriwijaya, Palembang, South Sumatera, Indonesia. The Ethical Review Committee for Research Involving Human Subject, University of Sriwijaya, Road Dr. Moh. Ali komplek RSMH Palembang 30126, South Sumatera, Indonesia. Tel. /Fax. +62711 352 342 / +62711 373 438, E-mail: tu@unsri.ac.id

I also have received **a copy of information sheet and informed consent form**.

Sign ……
(……..……)
Researcher

Sign ……
(……..……)
Participant

Sign ……
(……..……)
Parents or guardian of participant

Sign ……
(……..……)
Witness

APENDIX H

FORM OF THE TUG TEST SCORES (INDONESIA VERSION)

Tanggal : .....

No. Partisipan[*)] : .....(diisi oleh peneliti)

Tanggal lahir : .....

Umur : ..... tahun

Jenis kelamin : ☐ Laki-laki ☐Perempuan

Panjang tungkai : Kanan ..... cm

Kiri ..... cm

Tabel Nilai TUG test

Kelompok Eksperimental	**Nilai TUG test (detik)**			**Nilai Rata-rata**
	1	**2**	**3**	
1				
2				
3				
4				
5				
6				

APENDIX I

FORM OF THE TUG TEST SCORES (ENGLISH VERSION)

Date: .....

No. Participant*) : .....(filled by investigator)

Date of Birth : .....

Age : ..... years old

Gender : ☐ Boy ☐Girl

Leg Length : Right ..... cm

Left ..... cm

Table Outcome of TUG test

Experimental Conditions	**Outcome of TUG test Each Trials (seconds)**			**Mean Scores**
	1	**2**	**3**	
1				
2				
3				
4				
5				
6				

APPENDIX J
DRAWING LOTS

Lots A

1. Non-qualitative with line
2. Qualitative with a star picture
3. Non-qualitative with cone
4. Qualitative with cone
5. Non-qualitative with a star picture
6. Qualitative with line

Lots B

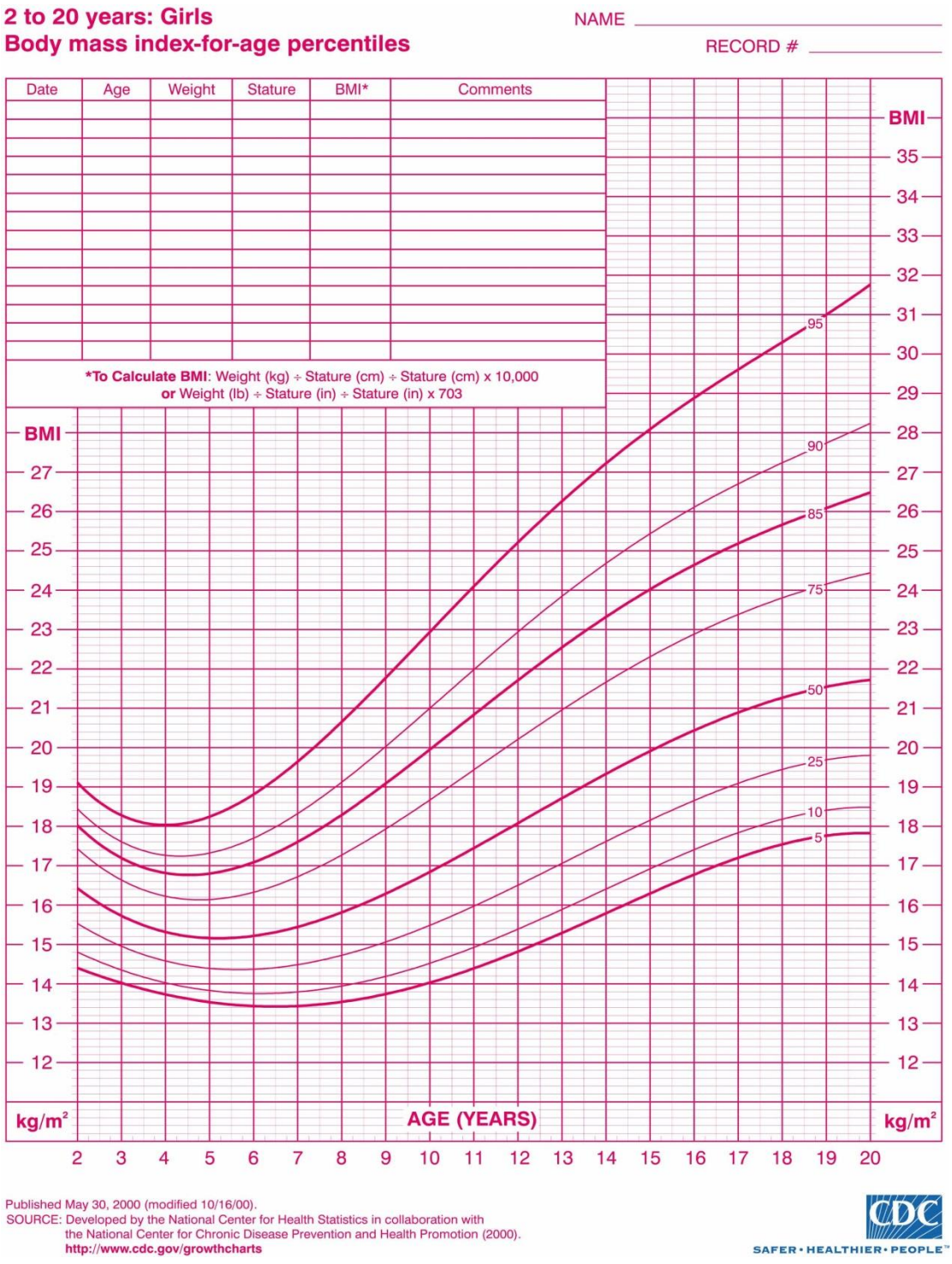
1. Non-qualitative with line
2. Qualitative with a star picture
3. Qualitative with line
4. Non-qualitative with cone
5. Non-qualitative with a star picture
6. Qualitative with cone

Lots C

1. Non-qualitative with cone
2. Qualitative with a star picture
3. Non-qualitative with line
4. Qualitative with cone
5. Non-qualitative with a star picture
6. Qualitative with line

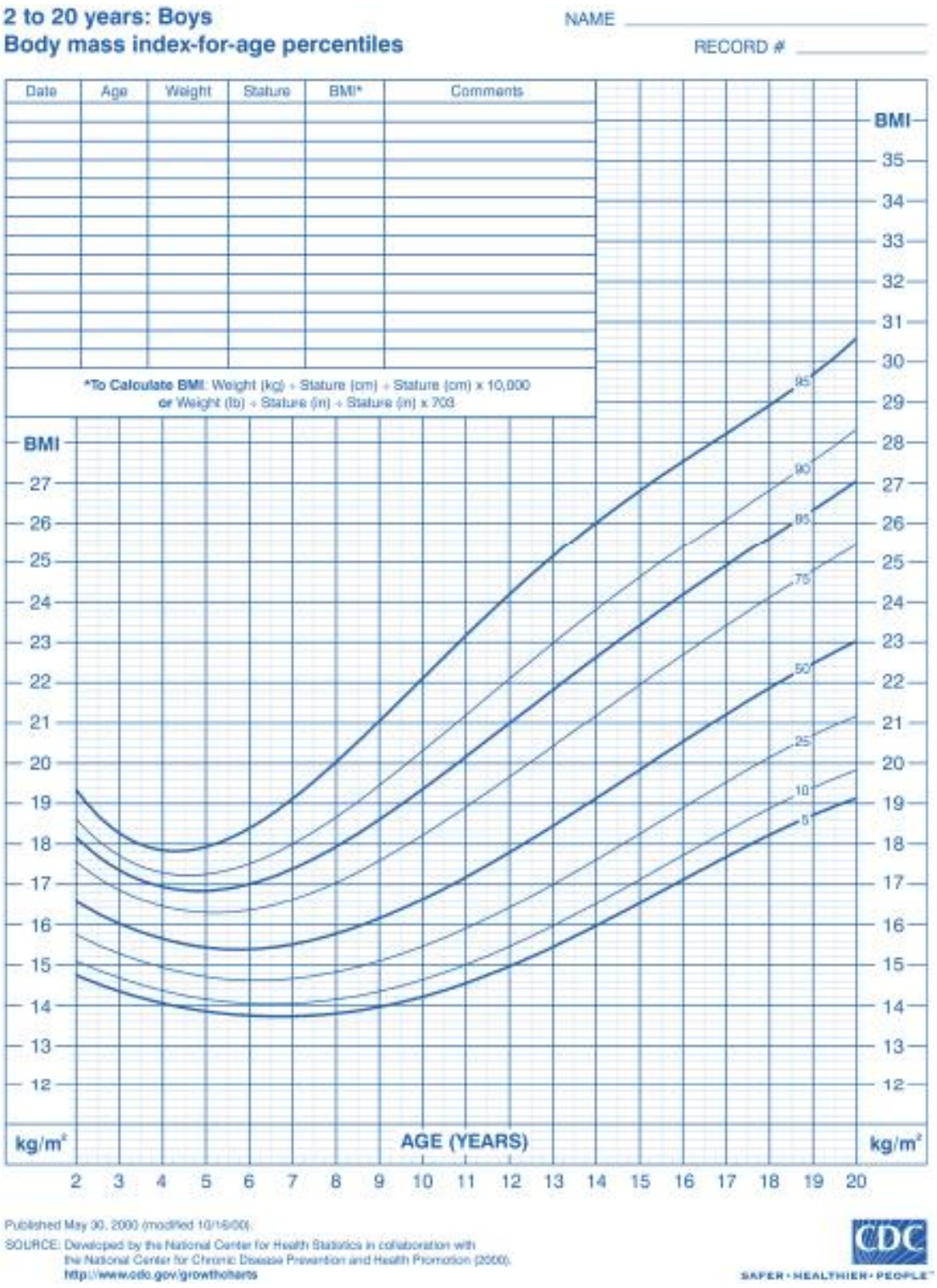
APPENDIX K

BODY MASS INDEX FOR GIRLS



APPENDIX L

BODY MASS INDEX FOR BOYS



APPENDIX M
INTRARATER AND INTERRATER RELIABILITY TEST

A. Introduction

The TUG test is a reliable outcome measure for measurement postural control in clinical settings and basic mobility skills in the elderly population [1,2]. The TUG test has also been used for children population [3]. Nowadays, many studies reported the TUG test in typical and atypical children using a similar procedure as it was applied in the elderly population and also using the different procedure that is specifically designed for children [3-6].

Although, there were a lots of studies report about reliability value in TUG test, it has been recommended that each study have to investigate the intrarater and interrater reliability in investigators should be tested as a standard. Therefore, this study aimed to determine the intrarater and interrater reliability between the investigator one and investigator two in measuring performances of the participants on TUG test using a stopwatch in typically developing children.

B. Study Design

An experimental study was conducted in thirty typical children.

C. Statistical Analysis

The statistical analysis was calculated by using SPSS® statistical software (IBM® SPSS® 22.0 version for windows). The Shapiro–Wilk test was used to evaluate the normality of the data and the Levene Test was used to evaluate the homogeneity of variances.

Three-way mixed ANOVA was used to describe effects of groups, conditions, and their interaction effect. Furthermore, intrarater and interrater reliability test was analyzed using the ICC (Intraclass correlation coefficients).

The ICC was used to test the level of agreement between the first researcher and the second researcher. The ICC values were interpreted as follows: the values less than 0.25 indicated no reliability, 0.25 – 0.50 indicated fair reliability, 0.51 – 0.75 indicated good reliability, and more than 0.75 indicated high reliability [8].

D. Equipment

Several equipment have been used in this study including (1) a stopwatch; (2) a cone; (3) line; (4) a star picture; and (5) an adjustable chair.

E. Participants

The participants were students of Sekolah Negeri 05 Inderalaya at South Sumatera Indonesia. Thirty typical children were participated in this study (15 boys and 15 girls, aged 6 to 12 years). They were recruited in this study if they (1) typical children of elementary school; (2) can walk independently; (3) have appropriate age with their weight and height; (4) can follow simple verbal instruction (such as “stand up” or “go”).

F. Procedure

All the participants performed the original TUG test as introduced by Podsiadlo and Ricardson. The measurement was conducted by two researchers. All of participants were asked to stand up from a standard arm chair. Then, the participants’ walked forward at a comfortable and safe pace within 3 meters distance. Lastly, the participants were turn around and walked back to the chair and finally sat down. The time was stop as soon as possible when the bottoms of participants touched the chair.

G. Results

Thirty subjects (15 boys and 15 girls), aged between 6 to 12 years old completed this study. The statistics descriptive data of participants were presented in table 1.1.

Table 1.1 Characteristics of Participants (n=30)

Data of Participants	Mean	SD	Minimum	Maximum
Aged			6	12
Height (cm)	134.98	11.33	113.00	157.00
Weight (kg)	32.14	6.86	20.70	46.00
BMI (kg/m2)	17.38	1.05	15.61	19.49
BMI Percentile	67.00	7.45	52.60	79.80
Leg Length (cm)	69.93	6.99	56.00	82.50

Table 1.2. The Intraclass Correlation Coefficients (ICC)

Interrater reliability	Intrarater reliability	Mean ± SD (sec)
.937	.967	7.77 ± 0.56

According to the figures, the ICC for inter– and intra-reliability test of performance of participants in TUG test were > 0.75 indicated high reliability.

H. Conclusion

The stopwatch was a reliable instrument for measuring the performance TUG test of participants in typical children. The results of intrarater and interrater reliability test in this study were good to high.

I. References

1. Podsiadlo D, Richardson S: **The Timed "Up & Go": A Test of Basic Functional Mobility for Frail Elderly Persons**. *Journal of the American Geriatrics Society* 1991, **39**(2):142-148.
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7. Bergmann JHM, Alexiou C, Smith ICH: **Procedural Differences Directly Affect Timed Up and Go Times**. *Journal of the American Geriatrics Society* 2009, **57**(11):2168-2169.
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9. Caroline B. Terwee, Leo D. Roorda, Dirk L. Knol, Michiel R. De Boer, Henrica C.W. De Vet: **Linking measurement error to minimal important change of patient-reported outcomes**: Journal of Clinical Epidemiology; 2009, 62(10): 1062-1067

APPENDIX N
SAMPLE SIZE CALCULATION

Aim

To determine the sample size that suited to the current study.

Method

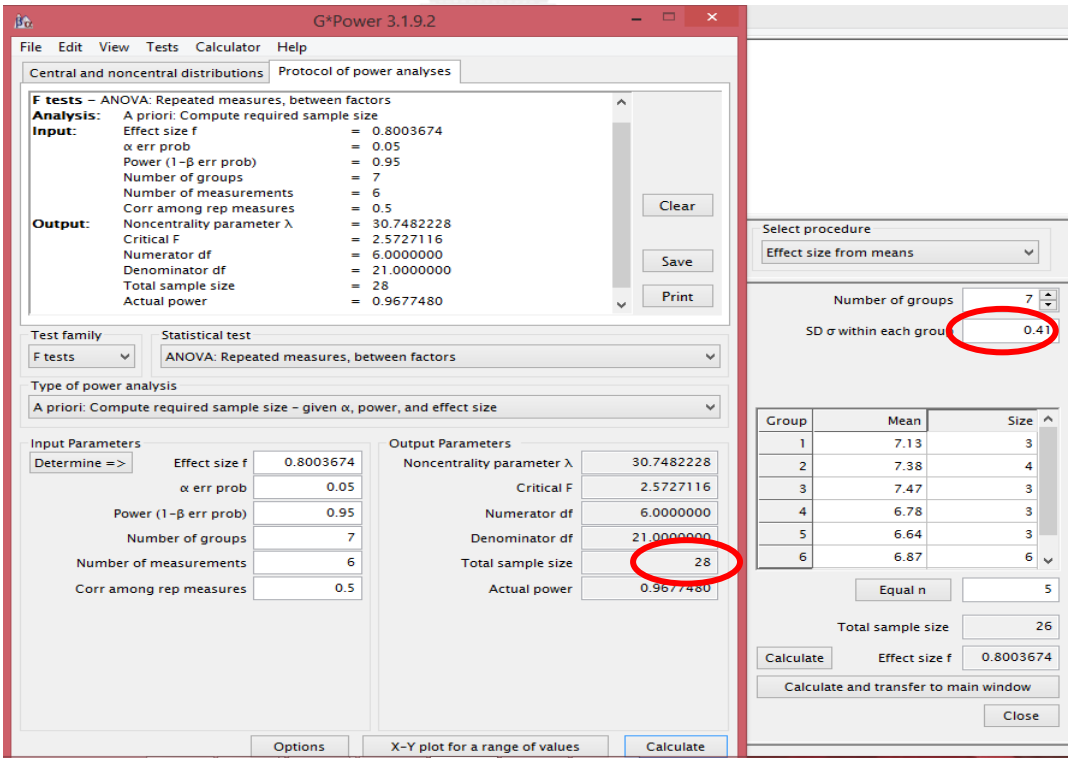
Sample size was calculated based on the result of pilot study (N=26) following the formula.

$$SD_\partial = \sqrt{\frac{(n_1-1)(SD_1)^2 + (n_2-1)(SD_2)^2 + (n_3-1)(SD_3)^2 + (n_4-1)(SD_4)^2 + (n_5-1)(SD_5)^2 + (n_6-1)(SD_6)^2 + (n_7-1)(SD_7)^2}{(n_1-1)+(n_2-1)+(n_3-1)+(n_4-1)+(n_5-1)+(n_6-1)+(n_7-1)}}$$

$$SD_\partial = \sqrt{\frac{(2)(0.47)^2 + (3)(0.43)^2 + (2)(0.50)^2 + (2)(0.49)^2 + (2)(0.42)^2 + (5)(0.39)^2 + (3)(0.18)^2}{(2+3+2+2+2+5+3)}}$$

$$SD_\partial = \sqrt{0.17}$$

$$SD_\partial = 0.41$$



The sample size was calculated use G*Power (3.1.9.2 Version) and the result showed the total of sample size to this study is 28 subjects. It is only estimate, the researchers make decision to improve the total sample size become 30 subjects each age group, with total at all in this study is 210 subjects.

VITA

Miss Ika Guslanda Bustam was born on December 10, 1989 in Kediri, West Java, Indonesia. Firstly, she graduated with Diploma's degree in 2010 from STIKes Muhammadiyah Palembang. In 2012, she graduate with a Bachelor's degree in Physical Therapy from Muhammadiyah Surakarta University, Indonesia. After her graduation, she worked at STIKes Muhammadiyah Palembang. In January 2015, she enrolled in a master degree in Pediatric field at department of Physical Therapy, faculty of Allied Health Sciences, Chulalongkorn University.