ERGONOMICS APPROACH TO ASSESS THE RISK ASSOCIATED WITH THE PERFORMANCE OF DOMESTIC TASKS–PART "B"

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ABSTRACT

Background: This work is a continuation with the previous work which used ergonomics approach to develop Task Assessment Tool for Ease and Risk (TAER) (Zaheer, et al., 2018). Now, this paper, describes the experimental trials and predictive validity of TAER.

Methods: The TEAR is based on self-assessment and consists of a booklet and recording sheet, booklet provide step by step guidelines about how to use TEAR. The experimental trials and predictive validity of TAER based on (a) ease of use of TAER record sheet and (b) validity study. TAER experimental trials overall used 20 healthy-able body participants and both trials were performed in participants' home environment. For the ease of use trial, carefully designed feedback questionnaire was used, while in predictive validity, TAER predicted risk is measured in relation with perceived discomfort through sensitivity analysis.

Result: In ease of use trial, feedback questionnaire confirmed that TAER is easy to use, free from ambiguity, applicable to almost all the tasks performed in home environment and almost all participants agreed that TAER do not need training for assessment. In predictive validity trials, the TAER predicted risk level is measured in relation with perceived discomfort and found that TAER has high sensitivity (78%), specificity (74%) and predictive values which revealed that TAER is a sensitive and useful tool for identifying risk and perceived discomfort in performing the daily tasks.

Conclusion: It is concluded that TAER record sheet is simple and easy to use, free from ambiguity and easily understandable and do not need training for assessment. In ease of use trials, it is confirmed that almost all participants able to self-assessed their performed tasks. It is also confirmed that, participant's self-assessed IADL exposure scores reasonably similar as compared to the researcher's assessed and revealed that regular use of TAER will help to obtained more accurate and reliable results.

Keywords: TAER (Task assessment tool for ease and risk), IADL (instrumental activities of daily living), Discomfort, Predictive validity, Sensitivity, Specificity.

1.0 Introduction

It is mentioned in previous work that in domestic environment three parameters are essentials whenever person performing the daily tasks (Zaheer, et al., 2018). These parameters are psychological perception of task, adopted postures and manual handling of objects and become essential and critical parameters for the developed self-assessment tool (TAER) particularly for the research that attempts to check the designed tools ease of use and its predictive validity. A precise and well-designed form for the self-assessment tool is like a conversation. It must be easy for ordinary people to use and understand, especially for people with a low literacy level. In order to use any tool for assessing tasks, it must have two elements, as defined by Karhu et al. (Karhu, Kansi, & Kuorinka, 1977) and Escobar (Escobar, 2006): (1) Simplicity: (the assessment tool should be simple enough to be used by an ordinary person) and (2) Exactitude: (the tool needs to be concise enough to avoid ambiguous answers). Therefore, it is necessary for the users to clearly understand the contents of the form or record sheet and be able to fill the form or record sheet without difficulty.

In the validity study TAER evaluated risk level is evaluated against the discomfort felt by participants during the performance of their daily tasks because performing a task in a non-neutral posture increases the physical demand required for that task (Zimmermann & Cook, 1999) and the person is susceptible to neck and back pain because the physical demand required for the task is a significant risk factor for musculoskeletal disorder (Allread, Wilkins III, Waters, & Marras, 2003; Kerr, 2000). According to Golafshani, "Validity determines whether the research truly measures that which it was intended to measure or how truthful the research results are" (Golafshani, 2003). There are many forms of validity (Krivonyak, 2008) , but the present study uses a technique called predictive validity, which measures how well the TAER can predict those daily tasks that entail a risk in relation to perceived discomfort. Predictive validity is measured by sensitivity and specificity (Krivonyak, 2008). Numerous studies have been found which used sensitivity and specificity analysis to validate the design assessment methods (Keyserling, Brouwer, & Silverstein, 1992; Krivonyak, 2008; Lin, 2011; Marley & Kumar, 1996), and it has therefore been decided to use this form of analysis to validate the TAER.

2.0 Methods

The task assessment tool for ease and risk (TAER) was developed to evaluate the risk associated with the performance of daily domestic tasks. The TAER consist of psychological (perceived physical demand required and perceived complexity) and physical (adopted postures and manual handling) risk factors associated with the performance of daily tasks. TAER assessment considered five main parts of the body (neck, arm, wrist, back and leg) for the evaluation of physical risk (adopted postures) which is associated with the performance of task. TAER has a risk rating score (1, 2 and 3) represented by respective colours (green, yellow and red) and the evaluation of final exposure score which revealed the implication about the task performed.

Figure 1: Task Assessment Tool for Ease and Risk (TAER) (Zaheer, et al., 2018).

Figure 1 shows the Task Assessment Tool for Ease and Risk (TAER) (Zaheer, et al., 2018). As this work is a continuation with the previous work where author mentioned two phases about TAER. Previous work (Zaheer, et al., 2018) only mentioned phase 1 which was the development procedure of TAER, now this paper describe the phase 2 which is experimental trials and the evaluation of predictive validity of TEAR.

2.1 Phase-2: Evaluation of the user trials of TAER record sheet

Figure 2 shows the overall development process of TAER, based on phase-I & phase-II. TAER has been developed for assessing the domestic tasks, in order to evaluate phase-II, experimental setup has been design and hire a voluntarily participants. Prior to experiment, provide TAER booklet to each participants which contain TAER record sheet, its introduction and step by step guide about how to use TAER. Ethics approval has been taken from University of Sheffield and all participants filled an informed consent prior to the trials.

TAER record sheet provide the information which is essential to evaluate the risk associated with the performance of task. So, record sheet should be simple and easy to understand by everyone. Before analysing the daily tasks, it is therefore necessary to make sure the quality of record sheet (means that anyone can understand the contents of record sheet and execute it easily). Apart from that, it is also important to investigate the validity of the designed tool. Therefore, this study is divided into two parts.
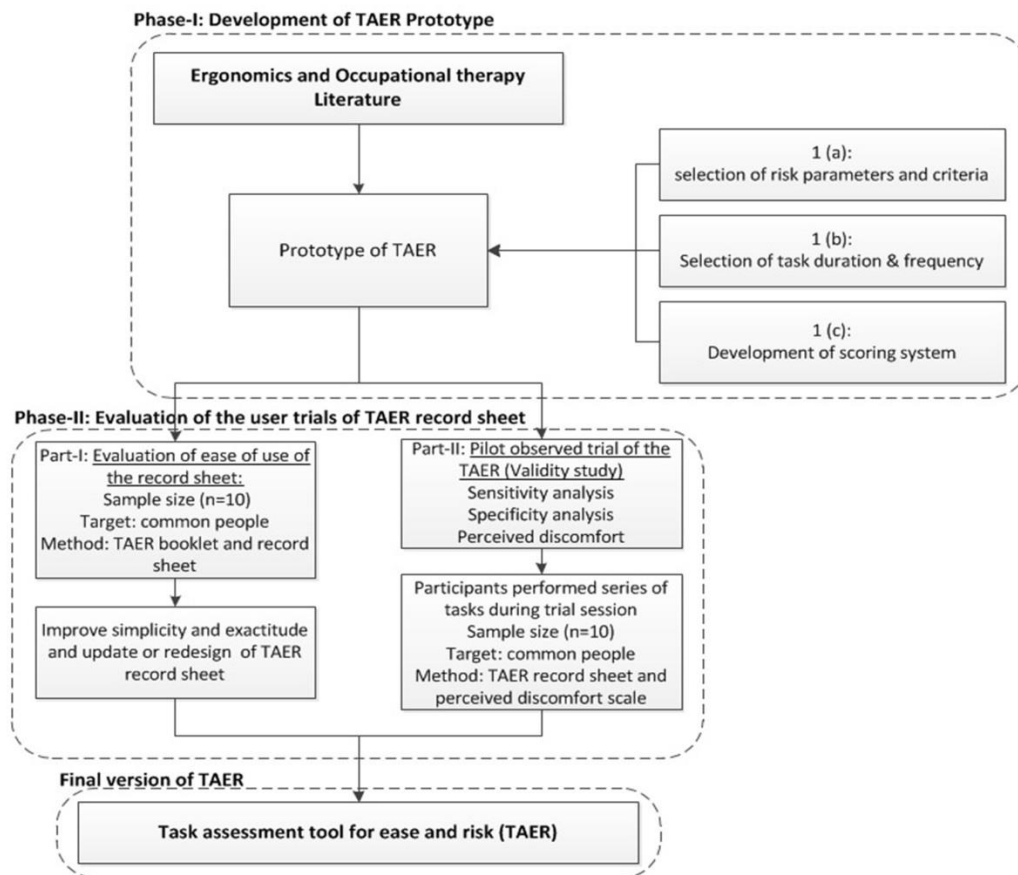
Figure 2: Shows the overall development process of TAER, based on phase-I & phase-II.

2.1.1 Part -I: Evaluation of the ease of use of the record sheet

The aim of the part-I is to analyse the ease of use of TAER record sheet by using health able-bodied participants. Each participant need to use three-point rating scale to rate his/her physiological perception, posture adopted and manual handling of objects during the performance of a task and record their risk level in recording sheet. Therefore, it is necessary to understand how to fill the record sheet by participants and easily understand its contents. Consequently, the study consists of the three steps:

(1) provide the TAER booklet and record sheet to do self-assessment
(2) explain the TAER record sheet and ask participants to redo the self-assessment, and
(3) researcher independently will do the assessment for the participants.

2.1.2 Part -II: Pilot observed trial of the TAER and predictive validity

The aim of the part-II is to quantify the risk and examine the validity of the TAER against the perceived discomfort. In this study, using designed TAER record sheet (see figure 1) to evaluate

the risk level, domestic load and also validating the TAER against the perceived discomfort in performing daily living tasks. This study used sensitivity and specificity indices to validate the TAER. Sensitivity can be measured as the proportion of those people having risk and feeling discomfort in performing daily tasks. It also reflects the ability of an exposure assessment tool to correctly identify positive tasks (those tasks predicted by the assessment tool to be hazardous) as problem tasks (resulting in illness or injury) (Eppes, 2004). It can be expressed mathematically as:

Sensitivity = True positive (TP)/(true positive (TP)+ false negative (FP)) (Parikh, Mathai, Parikh, Sekhar, & Thomas, 2008)

= Probability of having risk when feeling discomfort in performing daily tasks.

The sensitivity index indicates that the assessment tool can identify those tasks that involve risk and where the person feels discomfort in performing them. A trial which has a high numeric value of sensitivity helps to capture all possible subjects who are at risk and also feel discomfort in performing their daily activities (Zhu, Zeng, & Wang, 2010). Thus the sensitivity values easily screen out the tasks which need to be monitored. Specificity is the proportion of those people who are not at risk and do not feel any discomfort in performing their daily tasks. It refers to the ability of the exposure assessment tool to correctly identify negative tasks (those tasks predicted by the assessment tool to be safe) as safe tasks (not resulting in illness or injury). It can be mathematically expressed as:

Specificity = True negative (TN)/(true negative (TN) + false positive(FP)) (Parikh, et al., 2008).

= Probability of having no risk and feeling no discomfort in performing daily tasks.

Another term which is determined by sensitivity and specificity is accuracy, which measures the proportion of the correctly classified participants (TP+TN) within all participants (TP+ FP+ TN+ FN) (Zhu, et al., 2010). Accuracy through sensitivity and specificity measures the degree of veracity of the assessment tool on a specific condition (Zhu, et al., 2010).

2.2 Subjects:

Table 1 and 2 shows the number of participants in trials part-I and part-II. The study has used 10 participants in each because of the nature of the study as it is hard to gather data from the daily tasks performed by a person within domestic environment. However, there is evidence that many researchers used fewer participants in their studies and made good contribution to the knowledge (Aujla, Sandhu, & Kaur, 2008; Groborz, Tokarski, & Roman-Liu, 2011; Karhu, et al., 1977; Sullivan, McCarthy, White, Sullivan, & Dankaerts, 2012). Table 1 and 2 shows the further details about the participants.

Table 1 Number of participants participated in part-I

Age group (Years)	Number of subject participated	Male	Female	Location	Duration of study
40-60	10	5	5	Participant's home	30 minutes

Table 2 Number of participants participated in part-II.

Age group (Years)	Number of subject participated	Male	Female	Location	Duration of study (based on number of task performed)
20-39	6	3	3	Participant's home	1-2 hours
40-60	4	2	2	Participant's home	1-2 hours

2.3 Procedures

2.3.1 Part-I

TAER booklet and record sheet is provided to each participant and make sure that each participant read through the instruction and step by step guide. During the trials you asked to perform any daily task or you select any IADL task from the list provided with the booklet and performed normally and you analysed yourself using a TAER record sheet. As the participants are self-assessing their own performed tasks, the other thing to be considered is evaluation of total of rating scores of each variable, selection of multiplier, IADL exposure score and task risk level. Selection of multiplier is based on task duration and frequency, whereas IADL exposure score is the product of sum of the rating scores and selected multiplier.

2.3.2 Part-II

In this part, participants asked to carry out range of domestic tasks in a way that they performed normally. During the performance of each task participants has to think about task's psychological perception, (rate the physical demand and complexity), postures adopted (rate the most uncomfortable and dominating body parts positions) and, also consider manual handling of objects. Participants also instructed to record the frequency and duration of each task on record sheet. At the end, participants provided the TAER record sheets to researcher having self-assessed risk level for all the tasks performed during the trial secession. Researcher also informed the participants that their video is recorded during the performance of the tasks and recorded video is used by researcher to observe the adopted postures rate them by using TAER record sheet. Figure 3 shows only participant 1 snaps about the adopted postures and involved in manual handling during the trial session.

Figure 3 Participant 1 snaps about adopted postures and involved in manual handling of objects during the trial session.

3.0 Result and Discussion

During the user trials total 20 participants has performed different activities which are used to test the designed assessment tool. In part-I, 10 participants performed 10 different task while in part-II, 10 participants has performed 88 tasks.

3.1 Part-I: Evaluation of the ease of use of the record sheet

Table 3 shows the participants self-assessed, self-reassessed and researcher assessed exposure score and respective risk level. It is shown from the different IADL exposure scores that almost all the participants comfortably able to self-assessed their performed task but only one participant is found some problem because she is not good in understanding the English language, therefore researcher manage to make her understand in her own language and found that she did well in self-reassessed the performed task.

Table 3 Results of the analysis of ease of use of TAER record sheet.

Participants	Age (Years)	Gender	Task performed	Time spent (min)	IADL Exposure Score			Risk level
					Self-assessed	Self- re assessed	Researcher assessed	
P1	49	Male	Washing dishes	30	7.65	7.14	7.14	Moderate
P2	40	Male	Bed making	6	0.98	1.05	1.05	Low
P3	46	Male	Washing dishes	10	2.38	2.55	2.55	Moderate
P4	51	Male	Pushing shopping cart	15	0.8	0.7	0.8	Low
P5	40	Female	Cleaning bathroom	20	2.25	2.1	2.25	Moderate
P6	56	Female	Room cleaning	30	Not able to self-assessed	1.19	1.26	Low
P7	42	Male	Food preparation	25	5.78	5.1	4.76	High
P8	50	Female	hoovering	16	2.4	2.25	2.25	Moderate
P9	40	Female	Food preparation	30	9.18	8.16	7.65	High
P10	48	Male	Sweeping	15	3.23	3.23	2.89	Moderate

It is observed from table 3 there is some dissimilarity in participant's self-assessment and researcher assessment of IADL exposure score but have the same selected risk level. When the researcher explained the procedures then self-reassessment of some participants exactly match with the researcher assessed IADL exposure score which can easily be understood from figure 3. Therefore, it is concluded that if there is no explanation we might got conservative results and with some explanation we might got the more realistic and precise results. It is also possible that regular use of TAER will obtain precise and consistent results. Therefore, it is concluded that some sections of TAER record sheet might need explanation for some participants to obtained better results. Figure 4 shows the IADL exposure score of participant's self-assessed, self-reassessed and researcher assessed.
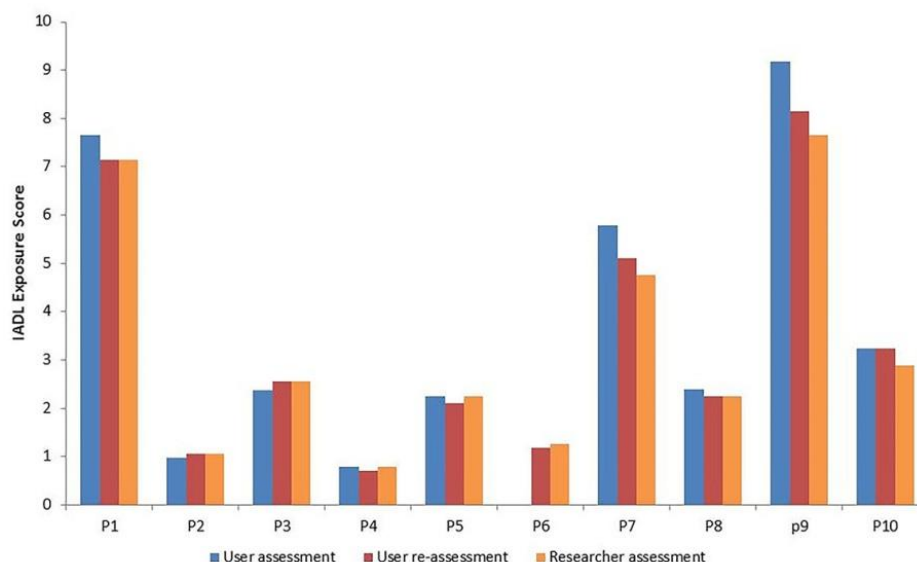
Figure 4 Participant's self-assessed, self-reassessed and researcher's assessed exposure score

Feedback questionnaire (see appendix 1) is used to determine the ease of use of TAER record sheet for all participants (n=20) (see table 4), using rating scale which represent 1 is strongly disagreed and 5 is strongly agreed. It shows that prototype of TAER is simple and easy to use (mean 4 ± 0.8 & mode 5), free from ambiguity and easily understandable (mean 4 ± 0.6 & mode 5), applicable to almost all the tasks performed in home environment (mean 4 ± 0.7 & mode 4) and do not need training for assessment (mean 4 ± 0.8, & mode 5). The participants confirmed that TAER scoring system is easy and understandable (mean 4 ± 0.9, mode 5), frequency and duration are easy to select from multiplier table (mean 5 ± 0.7, mode 5) and IADL exposure is easy to calculate (mean 5 ± 0.7, mode 5). Therefore, the selection of final risk also simple and easy (mean 5 ± 0.6, mode 5). Overall, participants rate TAER recording sheet as GOOD. It is inferred from the table 4, almost all participants are strongly agreed (based on the mode values, mean values might be confusing to make decision) with the all contents of the record sheet and concluded that TAER record sheet provide ease of use and provide reliable instrument to assess domestic environment. Table 4 shows the self-assessment ratings of feedback questionnaire of ease of use of the TAER record sheet.

Table 4 Feedback questionnaire results of using TAER record sheet.

S.No.	Statements	Rating Scale					Mean (SD)	Mode
		1	2	3	4	5		
1	TAER recording sheet is simple and easy to use.	-	1	1	7	11	4 (0.8)	5
2	TAER recording sheet is free from ambiguity and easily understandable.	-	-	1	9	10	4 (0.6)	5
3		-	-	2	10	8		4

	TAER is applicable to almost all the tasks performed in home environment.						4 (0.7)	
4	TAER do not need training to do assessment.	-	1	1	7	11	4 (0.8)	5
5	TAER scoring system (risk rating- low, moderate, high) is easy and understandable.	-	2	1	8	9	4 (0.9)	5
6	Frequency and duration multiplier are easy to select from the multiplier table.	-	-	2	4	14	5 (0.7)	5
7	IADL exposure score is easy to calculate.	-	-	1	3	16	5 (0.7)	5
8	Selection of final risk level (low, moderate, high) from risk rating table is easy.	-	-	1	4	15	5 (0.6)	5

3.2 Part-II: Pilot observed trial of the TAER and predictive validity

Table 5 shows the detailed results analysis of tasks by using TAER record sheet. It is shown that the number of tasks performed, time spent, number of tasks having low, moderate and high risk, participants' domestic load and overall risk due to performed tasks. It is inferred from the table 5 that all the participants successfully used the TAER record sheet to self-assessed their daily tasks and understand the significance of domestic load and overall risk.

Table 5 Results of the analysis of activities of daily living using TAER record sheet.

Participants	Age (years)	Gender	No. of tasks performed	Time spent	No. of tasks having			Domestic load (average exposure score)	Overall risk
					High Risk	Moderate Risk	Low Risk		
P1	33	Male	16	2hrs	1	3	12	1.18	Low
P2	29	Male	9	1hr 38 min	1	1	7	1.33	Low
P3	26	Male	11	1hr 39 min	0	3	8	1.1	Low
P4	36	Female	6	1hr 11min	0	2	4	1.38	Low
P5	42	Male	11	1hr 25min	0	3	8	1.13	Low
P6	40	Female	10	1hr 58min	1	6	3	2.3	Moderate
P7	51	Female	5	2hr 10min	0	2	3	2.67	Moderate

P8	34	Female	11	2hr 28min	0	5	6	1.95	Moderate
P9	36	Female	7	1hr	0	3	4	1.5	Low
P10	43	Male	2	1hr	0	1	1	3.34	Moderate

Descriptive statistic for IADL exposure scores assessed by participants and the researcher is shown in table 6. It shows that the self-assessed IADL exposure scores ranged from 0.08 to 6.12, with the mean of 1.56, shows a good spread and provides information that TAER will be able to discriminate between low and high risk task which helps us to prioritize the tasks with the known risk level. Although self-assessment mean IADL exposure score greater than researchers mean IADL exposure score which means during assessment participants overestimate the variables which revealed that participant's need to be more cautious when rating the variables.

Table 6 Descriptive statistics for participants and researcher assessment of IADL exposure score.

IADL exposure score assessment by	Mean	Median	Mode	Minimum	Maximum
Participants (self-assessment)	1.56	0.97	0.44	0.08	6.12
Researcher	1.52	0.82	0.52	0.09	7.65

Figure 5 compares the IADL exposure scores between participant's self-assessment and researcher assessment ($R^2 = 0.94$) during the user trial. It shows that the participant's self-assessed IADL exposure scores reasonably similar scores compared to the researcher's assessed IADL exposure scores. It also revealed that regular use of TAER assessment in daily tasks will help to obtained more accurate and reliable results. Similarly, figure 6 shows the participant's and researcher domestic load during the trial session. Domestic load defines as sum of all exposure scores divided by number of tasks performed by each participant. From the figure 5 it is clear that domestic load for participants (self-assessed) is less or over than the researcher assessed domestic load which revealed that some participants underrate or overrate the IADL exposure score during the trial sessions but end up with the same risk level, it assumed that regular use of TAER assessment will help them to obtain accurate result. The domestic load is helpful to predict the current domestic load with the previous domestic load which will help us to know how the person is coping with their daily tasks and also tell us about the person's ability and behaviour about the performance of basic essential tasks.

3.2.1 TAER validation:

In order to ascertain predictive validity of TAER, this study is using the techniques sensitivity, specificity and positive predictive values. Assessment tool's validation is essential because it provide the opportunity to compare the predicted risk in relation with of some conditions (incidence) such as any pain or ache or discomfort in performing the tasks, because the adopted

extreme or non-neutral postures associated with the discomfort (Breen, Pyper, Rusk, & Dockrell, 2007). A good assessment tool has the potential to discriminate between the two conditions, for this study the conditions are (i) risk and no risk, (ii) having discomfort and no discomfort. TAER has potential to segregate the task in high, moderate and low risk in relation with having perceived discomfort and no perceived discomfort. In order to calculate the predictive validity of TAER this study is using IADL exposure score cut off values. Those tasks having IADL exposure score equal and greater than one (IADL exposure score ≥ 1) consider as risky tasks and
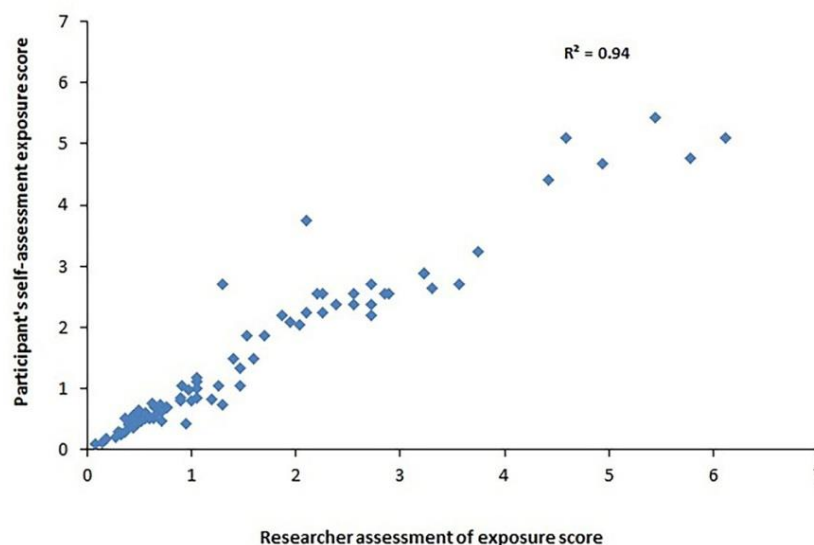
Figure 5 Comparison of self and researcher assessed exposure scores during trial session
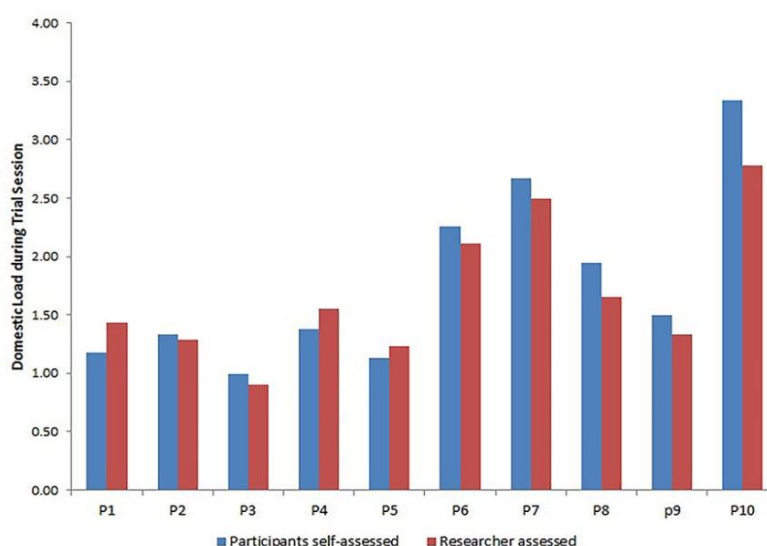
Figure 6 comparison of self and researcher assessed domestic load during trial session

those task having IADL exposure score less than one (IADL exposure score < 1) consider the tasks having no risk. The reason for using cut off values in IADL exposure score is that there are many tasks in domestic environment which took very less time (less than 5 minutes) to performed (e.g. brushing teeth, face wash and hair combing etc.) and having low risk level with IADL exposure scores less than 1, therefore assumed those tasks having no risk, which made the predictive calculation easy. Sensitivity, specificity, positive predictive values and accuracy analysis is performed between the TAER results and perceived discomfort (based on dichotomous scale) in performing the daily tasks.

Trial results have four possible interpretations two are correct (true positive and true negative) and two incorrect (false positive and false negative) as shown in two-by-two matrix (Chu, 1999) (see table 7). During trial section ten participants performed 88 tasks and segregated daily task in four categories that are risk and having discomfort called true positive (TP), risk and having no discomfort called false positive (FP), no risk and having discomfort called false negative (FN) and no risk and having no discomfort called true negative (TN). Table 7 shows the number of tasks within each category. To determine the ability of TAER to accurately categorize the person's risk level in performing the daily tasks, sensitivity, specificity and predictive indexes were determined by the formulas which are used by Marley and Kumar (1996) (Marley & Kumar, 1996). Table 7 shows the two columns and two rows indicated the real conditions of tasks performed by participant. The rows indicate the results of self-assessment of tasks by participants using TAER, having risk or no risk. The first cell in the matrix contains number of tasks (true positive) performed by participants having risk and discomfort. The fourth cell shows the number of tasks (true negative) having no risk and no discomfort.

Table 7 Shows the number of task within respective categories.

TAER Trial Results	Perceived Discomfort		Row Total
	(Yes)	(No)	
Risk (IADL exposure score ≥1)	32 (TP)	12 (FP)	44
No Risk (IADL exposure score <1)	9 (FN)	35 (TN)	44
Column Total	41	47	88

A good assessment tool will have minimal number of tasks in second (green) and third (light blue) cell. The second cell indicates the number of tasks having risk and not feeling any discomfort called false positive. Similarly, third cell indicates the number of tasks having no risk and feel discomfort called false negative. The assessment tool said to be efficient and performed well when it has higher number of participants in first (blue) and fourth (grey) cell, means it can predict both risk and no risk tasks with respect to perceived discomfort in domestic environment. Table 8 shows the numeric values of sensitivity, specificity, predictive values and accuracy. Sensitivity, specificity, positive and negative predictive values determine the usefulness of diagnostic assessment (Akobeng, 2006). The sensitivity value shows that self-assessed tasks by TAER can

identify those tasks that will very likely having risk and discomfort with 78% accuracy. It means that assessment tool has the ability to detect 78% people who feel discomfort and rate their tasks having risk, and miss only 22% people who have both conditions. The specificity value shows that the TAER can also have ability to predict and discriminate those people having no risk and not feeling discomfort with the accuracy of 74%. it means that assessment tool has the ability to detect 74% people who don't feel discomfort and rate their tasks having no risk. Predictive values measures the usefulness of an assessment test (Chu, 1999). The positive predictive value measures the proportion true positive within all tasks rated as having risk and the negative predictive value measures the proportion true negative within all tasks rated as not having risk by TAER.

Table 8 Sensitivity, specificity, predictive values and accuracy of TAER in relation with perceived discomfort in performing the daily tasks.

TAER predictive validity		Formula used (Zhu, et al., 2010)
Sensitivity	78%	$\{TP/ (TP+FN)\}*100\%$
Specificity	74%	$\{TN/ (TN+FP)\}*100\%$
Positive predictive value	73%	$\{TP/ (TP+FP)\}*100\%$
Negative predictive value	80%	$\{TN/ (TN+FN)\}*100\%$
Accuracy	76%	$\{(TP+TN)/ (TP+FP+FN+TN)\}*100\%$

The positive predictive value indicates the proportion of those tasks performed by participants having risk and discomfort within all the tasks having risk predicted by TAER, which means that 73% of participants who have identified their tasks having risk also feel the discomfort in performing the tasks. The negative predictive value indicates the proportion of those participants having no risk and feel no discomfort, which means that 80% of participants who have identified their tasks having no risk also not feel the discomfort in performing the tasks. The positive and negative predictive values depend upon the occurrence of condition (e.g. number of tasks people feeling or not feeling discomfort in performing the tasks (Chu, 1999)) in examined participants. Therefore, positive and negative predictive values is varying from study to study depend upon the occurrence of condition. Accuracy of assessment tool measures the proportion of correctly identify tasks either true positive and true negative. The calculated value of accuracy is 76%, which means designed tools have good proportion to identify true results (both true positive and true negative) in the studied population.

The sensitivity, specificity, predictive values and accuracy of newly developed assessment tool is essential because it gives the idea of accuracy about assessment uncertainty when employed (Krivonyak, 2008). High sensitivity and specificity values which would ensure the false negative (no risk but having discomfort) and false positive (risk but no discomfort) were minimized which represent the significance and level of accuracy of TAER. TAER has both high sensitivity and specificity which revealed that TAER has been validated and provide the good knowledge between

the risk and conditions such as perceived discomfort which is associated with performing the tasks and also useful for identifying the tasks that might pose risk for injury. Moreover, it is believed that TAER may play vital role in the development of comprehensive and proactive strategies for the detection of problems related to the home environment and manage them effectively before it can affect our quality of life.

4.0 Conclusion

The task assessment tool (TAER) for domestic environment was developed which based on self-assessment and provides the knowledge about the risk associated with the performance of daily tasks (Zaheer, et al., 2018). In ease of use trials, it is confirmed that almost all participants able to self-assessed their performed tasks although there were some dissimilarity in participant's self-assessment and researcher assessment of IADL exposure score but have the same selected risk level and it is assumed that regular use of TAER record sheet will obtain precise and consistent results. Feedback questionnaire confirmed that TAER record sheet is simple and easy to use, free from ambiguity and easily understandable and do not need training for assessment. Therefore, it is concluded that TAER record sheet provide ease of use and provide reliable instrument to assess domestic environment. In the validity trials, the TAER predicted risk level is measured in relation with perceived discomfort and found that TAER has high sensitivity (78%), specificity (74%) and predictive values which revealed that TAER is a sensitive and useful tool for identifying risk and perceived discomfort in performing the daily tasks. It also shows high positive predictive (73%) value, which revealed the usefulness of an assessment tool (Chu, 1999). Therefore, it is confirmed that TAER efficiently identified those tasks in which participants felt discomfort, within all the tasks predicted by TAER as having risk. It is also confirmed that accuracy of TAER (76%), which inferred that TAER has ability to identify true results in the studied population. Overall it is concluded that TAER has both high sensitivity and specificity which revealed that TAER has been validated and provide the good knowledge about our daily essential tasks and also helpful for identifying the tasks that might pose risk for injury in later stages of life.

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Declaration

The authors declare that there is no conflict of interest regarding publication of this article.

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Appendix 1: Task assessment tool for ease and risk (TAER) record sheet feedback:

1. Please rate the TAER record sheet on the following statements by using 5 point scale (1= strongly disagree to 5= strongly agree)

Statements	Rating scale				
	1	**2**	**3**	**4**	**5**
• TAER recording sheet is simple and easy to use	1	2	3	4	5
• TAER recording sheet is free from ambiguity and easily understandable	1	2	3	4	5
• TAER is applicable to almost all the tasks performed in home environment	1	2	3	4	5
• TAER do not need training to do assessment	1	2	3	4	5
• TAER scoring system (risk rating- low, moderate, high) is easy and understandable	1	2	3	4	5
• Frequency and duration multiplier are easy to select from the multiplier table	1	2	3	4	5
• IADL exposure score is easy to calculate	1	2	3	4	5
• Selection of final risk level (low, moderate, high) from risk rating table is easy	1	2	3	4	5

2. What did you like most about TAER booklet and recording sheet?

3. What do you find difficult about TAER recording sheet and why?

4. What aspect of the recording sheet could be improved?

5. Any other comments

6. Overall, I would rate TAER record sheet as: (please circle)

Good   Average   Poor

Thank you for your feedback