

Original Research Article

Development of Questionnaire for Ergonomic Evaluation, Its Cultural Adaptation and Its Validation for Traditional Small Scale Industries

Dr. Chandni Shah¹, Dr. Neeta J. Vyas²

¹Ph.D. Scholar, Gujarat University, Ahmedabad

²Principal, IKDRC-ITS, Civil Hospital Campus, Asarwa, Ahmedabad

Corresponding Author: Dr. Chandni Shah

ABSTRACT

Introduction: Ergonomics simply means fitting job to the person. Musculoskeletal disorders (MSDs) are currently one of the most critical problems globally faced by the ergonomists in the workplace. Recent era each and every occupation demands ergonomically design job to prevent musculoskeletal disorders. Small-scale industries (SSIs) have been playing an important role in the overall economic development of India. It plays an important role in minimizing economic problems through dividing employment with lower investment. Traditional small industries include *khadi* and handloom, village industries, handicrafts, sericulture, coir etc. Occupations with the highest number of new MSD cases are 101 per 100,000 workers of Craft and trade workers. Very less no. of ergonomic questionnaires are available for traditional small scale industries.

Need of Study: To design questionnaire for ergonomic evaluation and its cultural adaptation for traditional small scale industries

Methodology: Questionnaire development for ergonomic evaluation was done under the subtitle of personal information, work information, general health information, occupational problem assessment, pain assessment, knowledge of ergonomics. Two steps were proceeded: 1) cultural adaptation was done on general population (100) and (50) handicraft workers of different NGOs of Ahmedabad. 2) Face validity and content validity of questionnaire was assessed. 3) Intrarater and interrater reliability was assessed.

Results: Cronbach's alpha was calculated for internal consistency. Its value was found was >0.9 .

Conclusion: A cross-culturally validated questionnaire of Ergonomic evaluation cannot just help ensure an accurate evaluation of ergonomics, but is also a valuable asset for future comparison and evaluation of MSD and ergonomic evaluation across the world.

Key Words: Ergonomics, Questionnaire, Musculo-skeletal disorders, reliability, validity, traditional small scale industry

INTRODUCTION

The definition of Small Scale Industry in India has changed from time to time. It is currently defined in terms of investment Ceilings on the original value of Installed plant and machinery is Rs.1 crore at present. The SSIs in India are broadly classified into two types: Traditional

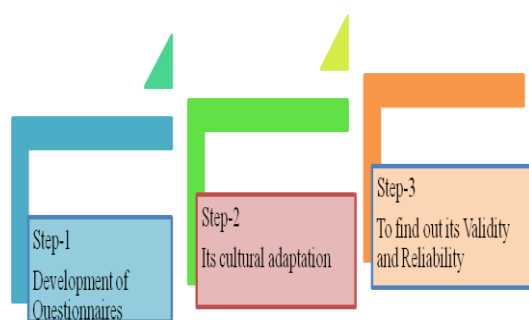
industries and Modern industries. Under traditional industries basically handicraft, Khadi village industries, handlooms, Sericulture etc. are included. ⁽¹⁾ Modern SSI industries include small scale, export oriented ancillaries and small scale service and business enterprise. ⁽¹⁾ India has a rich heritage of manual work in handicrafts like:

hand block printed textiles, blue pottery, jems, jewelry, sculpture, textile screen printing, and wood handicraft etc. ⁽²⁾ Handicraft workers are prone to musculoskeletal disorders (MSDs) due to unnatural work postures, unsafe working practices, long working hours and many risks of work accidents caused by unsafe conditions. ⁽³⁾

Ergonomics is the scientific study of the relationship between man and his working environment, his tools and materials, his methods of work and the organization of his work, either as an individual or within a working group. ⁽⁴⁾ To evaluate Work Related Musculoskeletal Disorders, the questionnaires which were developed generally designed for computer users, not specifically designed for traditionally small scale industries. So the aim of the study was to design questionnaire for ergonomic evaluation in traditional small scale industries. Objectives were to perform cultural adaptation of designed questionnaire and to find out reliability and validity of ergonomic questionnaire.

MATERIALS AND METHODOLOGY

METHODOLOGY:



- **Study Design:** Cultural and validation study protocol
- **Study Setting:** 2 NGOs of Ahmedabad, normal healthy population of Ahmedabad
- **Sample selection:** 100 people(General Population of Ahmedabad) and Handicraft workers(50)(42 female,8 male) from VeparMfg Limited,

Kotarpur, Ahmedabad and Jyotisangh, Ahmedabad

- **Sample Design:** Convenience sampling
- **Study Duration:** One session study
- **Inclusion Criteria:**
 1. Self-employed Handicraft workers and workers from small scale industries and general healthy population
 2. Age:20-45 years
 3. Both genders are included
 4. Worker's willingness to participate in study
- **Exclusion Criteria:**
 1. Worker/person who is not able to read (for cultural adaptation)
 2. Worker who is not able to understand basic Gujarati/English language(for cultural adaptation)
- **Materials Used in Study:** Self Designed Ergonomic Questionnaire, Pen, Pencil, Paper, Consent form
- **Procedure:**

STEP-1 DEVELOPMENT OF QUESTIONNAIRE:

Ergonomic questionnaire was developed to evaluate Musculoskeletal disorders due to poor ergonomics and awareness of workers for ergonomic factors responsible for W.R.M.S.D.(Work related musculoskeletal disorders).According to guideline of OSHA(Occupational Safety and Health Administration) questionnaire was developed. ⁽⁵⁾

Total 31 questions were formulated. Evaluation by Ergonomic questionnaire was done under following components:

- 1) Personal information: 12
- 2) Work Information: 3
- 3) General Health Information: 2
- 4) Occupational Assessment: 5
- 5) Pain assessment: 6
- 6) Knowledge of Ergonomics: 3

Domain of Ergonomic Questionnaire and its Scoring system

Domain	Maximum Score	Minimum Score
A)Personal Information	2	0
B)Work Information	3	1
C)General Health Information	2	0
D)Occupational Risk Assessment	16	2
E)Pain Assessment	43	0
F)Knowledge of Ergonomics	2	1

Interpretation of Score:

It would be according to the domain, from which one is able to understand the correlation of W.R.M.S.D.(Work related musculoskeletal disorders) and Ergonomic factors.

STEP-2 CULTURAL ADAPTATION:

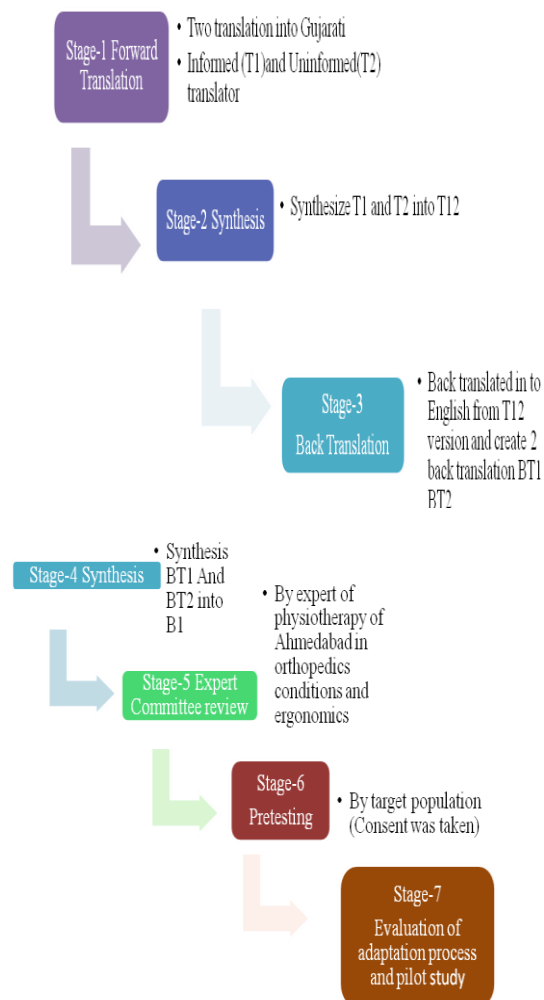


Figure:1 Process of Cultural Adaptation of Questionnaire (6-8)

STEP-3 (A) VALIDATION OF QUESTIONNAIRE:

Content validity and Face validity was assessed. (9) It was found valid instrument to assess ergonomic problems in handicraft workers. Content validity: From this questionnaire one can assess W.R.M.S.D. ergonomic factors for W.R.M.S.D. in handicraft workers. Experts of physiotherapy have reviewed and content validity was found good. Face validity was found good. It is the instrument which was found to evaluate Ergonomic as it was

properly construct under specific domain of ergonomics.

STEP-3(B) RELIABILITY OF QUESTIONNAIRE:

Reliability of questionnaire was tested. (9) Test-Retest Reliability was tested over period of 1 week by one rater. Intra-rater reliability was tested for 2 times by one rater. Inter-rater reliability was also tested by giving questionnaire to two raters.

RESULTS

For cultural adaptation the sample which was selected from normal healthy population and traditional small scale handicraft industries, the gender distribution was as following:

Table No: 1 Gender Distribution

Gender	General Population	Artisans	Total
Male	46	8	54
Female	54	42	96
Total	100	50	150

Table No: 2 displays the statistics of age distributions of 150 total persons (100 General population & 50 artisans).

Table No: 2 Age Distribution

Gender	N	Mean	SD
Male	54	34.08	6.19
Female	96	33.44	5.73

Face validity and Content validity of questionnaire was tested. The results were as following:

Table No: 3 Validity of Questionnaire

Validity	
Content Validity	Good
Face Validity	Good

Results of Inter-rater reliability, Intra-rater reliability and Test-Retest reliability were calculated in Microsoft Excel and were as following:

Table No:4 Reliability of Self-Developed Questionnaire

Reliability	
Intra-class Correlation Coefficient (For Intra-rater reliability)	ICC=0.98
Spearman's Correlation(For Inter-rater reliability)	r=0.80
Cronbach's Alpha (For test-retest reliability)	r=0.92

DISCUSSION

The presented results are showing that the Self Designed Ergonomic Questionnaire is helpful tool to identify W.R.M.S.D. and ergonomic problems in traditional small scale industries. The questionnaire was structured to gather the information about risk factors which produces W.R.M.S.D. in handicraft workers. It was also aimed to identify the body part which can be commonly affected with specific handicraft work, so specific ergonomic training can be provided. The questionnaire is also helpful to assess thorough occupational assessment of any worker under its occupational domain which includes all the questions like risk factors for W.R.M.S.D, working position, no. of working hours/day etc. For Question No: 1 Under Domain of occupation risk assessment artisans were refusing for any musculoskeletal problems but by filling of further questionnaire it was found the unawareness about W.R.M.S.D. and Ergonomics. For Question No:3 under Domain of Knowledge of ergonomics workers would be agree to change the work position , instrument, environment , but employer's permission constrain was there. The questionnaire has covered the all aspects of ergonomic evaluation and the questions were designed generally requires answers in nominal data (Yes/No)/ likert scale. It contains only 31 questions, in user-friendly language which requires 5-7 minutes of time. From designing point of view, it may become useful tool for ergonomic evaluation in traditional small scale industries.

With the growth of the number of questionnaires developed for a specific culture, their use in other countries, cultures, and languages has become an important tool with the cross cultural adaptation process. The cross-cultural adaptation process should follow established rules because the adaptation of a questionnaire to be used in another country, culture, or tongue needs a method to keep equivalence between the original and the adapted questionnaires. The

questionnaire items should be well translated and be culturally adapted to keep the validity of the instrument (Beaton et al., 2000).⁽¹¹⁾ The proposed questionnaire has followed all the procedure for cultural adaptation.⁽¹²⁾

To quantify the level of agreement for this questionnaire among the specialists during the evaluation of the content validity, different methods can be used. Percentage agreement score, content validity index, kappa Co-efficient. In this study for content validity of questionnaire percentage agreement score of experts was taken and it was found about 90%.

Reliability is the ability to consistently reproduce a result in time and space, or using different observers (Contandriopoulos, 1999).⁽¹³⁾ It indicates aspects about the questionnaire coherence, precision, stability, equivalence, and homogeneity (Lobiondo& Haber, 2001).⁽¹⁴⁾ It can be evaluated by three different methods: the stability (test-retest), the homogeneity, and the equivalence (inter-observer).The stability aim to analyze the consistency of the instrument when repeating the measures using a test-retest design. The Cronbach's alpha for the internal consistency of this Ergonomic Questionnaire was found 0.92. Regarding the questionnaire subgroups, according to the different handicrafts in which they were collected, the Cronbach's alpha found varied between 0.76 and 0.94. The homogeneity or internal consistency can be evaluated to verify whether all items of a questionnaire are related to different aspects of the same construct. Using this method, you can verify if the questions of the instrument measure the same concept (Lobiondo & Haber, 2001).⁽¹⁴⁾The equivalence reliability is an inter-observer measure and it allows verifying whether the administration of a specific instrument by two different persons will provide the same results. It was found $r=0.80$, which is good.

Ansari, et al. (2013) noticed on the ergonomics consideration required to be governed in the small scale industries

(SSIs). ⁽¹⁵⁾ The Institute for Occupational Ergonomics (1999) defined ergonomics as an understanding of the needs, limitations, and abilities of people, and the use of this understanding for the design of products and environments in which people live. Motamedzade et al. studied the ergonomic design of carpet weaving hand tools. ⁽⁹⁾ From the usability test, it could be concluded that, new hand tools caused the concentration of contact stress on the palm of hand to be eliminated. There is need for evaluation of ergonomic factors in traditional small scale industries for the worker awareness for W.R.M.S.D. and the training for the correction of the same can be implemented.

CONCLUSION

Self-Designed questionnaire for ergonomic evaluation can be used to evaluate ergonomic factors and its role on W.R.M.S.D. in traditional small scale industries. It is reliable and valid tool to assess ergonomic problem in traditional small scale industries.

LIMITATIONS:

- Questionnaire cross-cultural adaptation population selected from different area of Ahmedabad only, need to explore other areas of Gujarat
- In questionnaire general health domain has not much discussed
- Illiterate person/artisans would not be able to participate as it is self-reported measure.

REFERENCES

1. Dr. Reetu Sharma. Problems and prospects of small scale industrial units (a case study of exporting and non-exporting units in Haryana) IRJC Asia pacific journal of marketing & management review vol.1 no. 2, October (2012), ISSN 2319-2836
2. M. L. Meena, G. S. Dangaych and A. Bhardwaj. An ergonomic approach to design hand block tool for textile printing handicraft industry. International journal of recent advances in mechanical engineering (ijmech) vol.4, no.4, November (2015)
3. Buckle p, devereux j. Work related neck and upper limb musculoskeletal disorders.

- Bilbao, Spain: European agency for safety and health at work (1999)
4. M.L.Meena, Dr. G.S. Dangayach and Dr. A. Bhardwaj. Impact of ergonomic factors in handicraft industries. international conference on mechanical, production and automobile engineering (icmpae'2011) pattaya Dec.(2011)
 5. OSHA 3125,2000 (revised)OSHA ergonomic guidelines: Ergonomics: the study of work U.S. Department of labor, bureau of labor statistics, news release,
 6. Bullinger M, Alonso J, Apolone G, Lepège A, Sullivan M, et al. (1998) translating health Knowledge of heart-healthy foods, and label-reading skills in adults with diabetes status questionnaires and evaluating their quality: the iqola project approach. International quality of life assessment. J clinepidemiol 51: 913-923.
 7. Beaton De, Bombardier C, Guillemin F, Ferraz Mb (2000) guidelines for the process of Cross-cultural adaptation of self-report measures. Spine (phila pa 1976) 25: 3186-3191.
 8. Wild D, Grove A, Martin M, Eremenco Mas, Mcelroy Bas et al. (2005) principles of good practice for the translation and cultural adaptation process for patient-reported outcomes (pro) measures: report of the ispor task force for translation and cultural adaptation. Value health j intsocpharmacoeconomics outcomes res 8: 94–104.
 9. Damato S, Bonatti C, Frigo V, Pappagallo S, et al. Validation of the Clinical COPD questionnaire in Italian language. Health and Quality of Life Outcomes 2005, 3:9.
 10. Beaton DE, Bombardier C, Guillemin F & FerrazMB. (2000).Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine*, Vol.25, No. 24, pp. (3185-91).
 11. Marina ZambonOrpinelliColuci (2012). Measurement Instruments for Ergonomics Surveys – Methodological Guidelines, Ergonomics - A Systems Approach, Dr. Isabel L. Nunes (Ed.), ISBN: 978-953-51-0601-2
 12. Contandriopoulos AP. (1999). How to prepare a research. (3rd ed.), Hucitec/Abrasco, São Paulo.
 13. Lobiondo G & Haber J. (2001). Research in nursing: methods, critical evaluation, and utilization.(4th ed.), Guanabara Koogan, Rio de Janeiro.

14. Lobiondo G & Haber J. (2001). Research in nursing: methods, critical evaluation, and utilization.(4th ed.), Guanabara Koogan, Rio de Janeiro. Postures of Workers Working In SSI by Using Reba International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249-8958, Volume-2, Issue-3, February (2013)
15. N. A. Ansari, P. N. Shende, M. J. Sheikh, R. D. Vaidya; Study and Justification of Body

How to cite this article: Shah C, Vyas NJ. Development of questionnaire for ergonomic evaluation, its cultural adaptation and its validation for traditional small scale industries. Int J Health Sci Res. 2019; 9(6):99-104.
