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# WORK AND WORK LOAD OF NURSERY TEACHERS IN INSTITUTIONS FOR MENTALLY AND PHYSICALLY HANDICAPPED CHILDREN

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**ABSTRACT**

The work and work load of two nursery teachers in two institutions for the handicapped children and of a nursery teacher at a nursery school for healthy children were studied, by means of a time lapsed video tape-recorder with a time marker. The teachers' activities were divided into 14 units of work, 20 elements of posture and 45 elements of movement, and analysed at one-second intervals. The actual time and frequency of each divided factor and crossed factors are presented.

With the development of social welfare services in the last two decades in Japan, the number of the institutions for children has increased rapidly. There are numbers of the nursery schools for healthy children aged 0–5 and the institutions for the handicapped (approximately 20 000). About 250 000 female workers are employed in these institutions. An increasing tendency has been observed among the workers, especially nursery teachers, to complain of chronic fatigue, low back pain and the pain in the neck, shoulder and arms, etc.

The field studies carried out since 1972[4,6] proved that 4–5% of the nursery teachers needed therapy for either low back pain or cervicobrachial syndrome, and 8% of them needed clinical observation (Table 1). The number of those with a past and present history of both diseases increased with the years of work as shown in Table 2.

The fatigue accumulated during work was considered as a major aetiological factor of health injuries, and many other factors such as the shortage of regular staffs, enhanced output, lack of rest period, awkward working posture, inadequate conditions of working environment, floor arrangement, equipments, standardization of work and health administration, were found to have increased the work load.

TABLE 1
Results of health examination of female workers in social welfare institutions (%).

| Occupation | No. of examinees | Healthy | Subclinical (I)* | Subclinical (II)* | Illness (III-V)* |
|---|---|---|---|---|---|
| Nursery teachers for handicapped children | 159 | 50.3 | 35.8 | 8.8 | 5.0 |
| Nursery teachers for healthy children | 2253 | 58.3 | 30.4 | 7.7 | 3.9 |
| Cooks | 410 | 57.8 | 29.8 | 9.1 | 3.4 |
| Others | 346 | 59.2 | 25.7 | 8.4 | 6.6 |

*Health examinations for occupational low back pain and cervicobrachial syndrome were carried out in female workers in six cities. The classification of health conditions (I–V) corresponds to that of "Occupational Cervicobrachial Disorders" presented by the Committee on Cervicobrachial Syndrome of the Japanese Association of Industrial Health (1973), cf. Ref. 5.

TABLE 2
Experience of low back pain and cervicobrachial syndrome by years of work of nursery teachers*.

| Experience period (years) | Number of subjects | Low back pain (%) | Cervicobrachial syndrome (%) |
|---|---|---|---|
| Less than 1 | 115 | 1.7 | 2.6 |
| 1 to 3 | 200 | 7.0 | 18.5 |
| 3 to 5 | 142 | 13.4 | 21.1 |
| 5 to 10 | 116 | 24.1 | 32.8 |
| More than 10 | 68 | 20.6 | 20.6 |
| Total | 641 | 12.0 | 19.0 |

*Data from the health examinations conducted in two out of six cities shown in Table 1.

The measures for the prevention of occupational health injuries, require an analysis of the work and work load. In the case of nursery teachers, however, the activities are so various that many difficulties are encountered in analysing the problem[1,2,6].

In this report we present the results of the studies on the work and its load in two public institutions for mentally and physically handicapped children and in a nursery school.

## METHOD

The work content, working posture and working movement were studied in three healthy teachers in three institutions: (1) teacher A, age 32, married, teaching in a special class for mentally and physically handicapped children in a public elementary school (24 handicapped children, average weight 16.2 kg, and 12 teachers), (2) teacher B, age 23, single, teaching in a public home for mentally handicapped children (52 children aged 7–20 and 26 teachers), (3) teacher C, age 21, single, teaching in a class for infants aged under two years in a public nursery school (16 infants and 6 teachers out of altogether 138 children aged 0–5 and 31

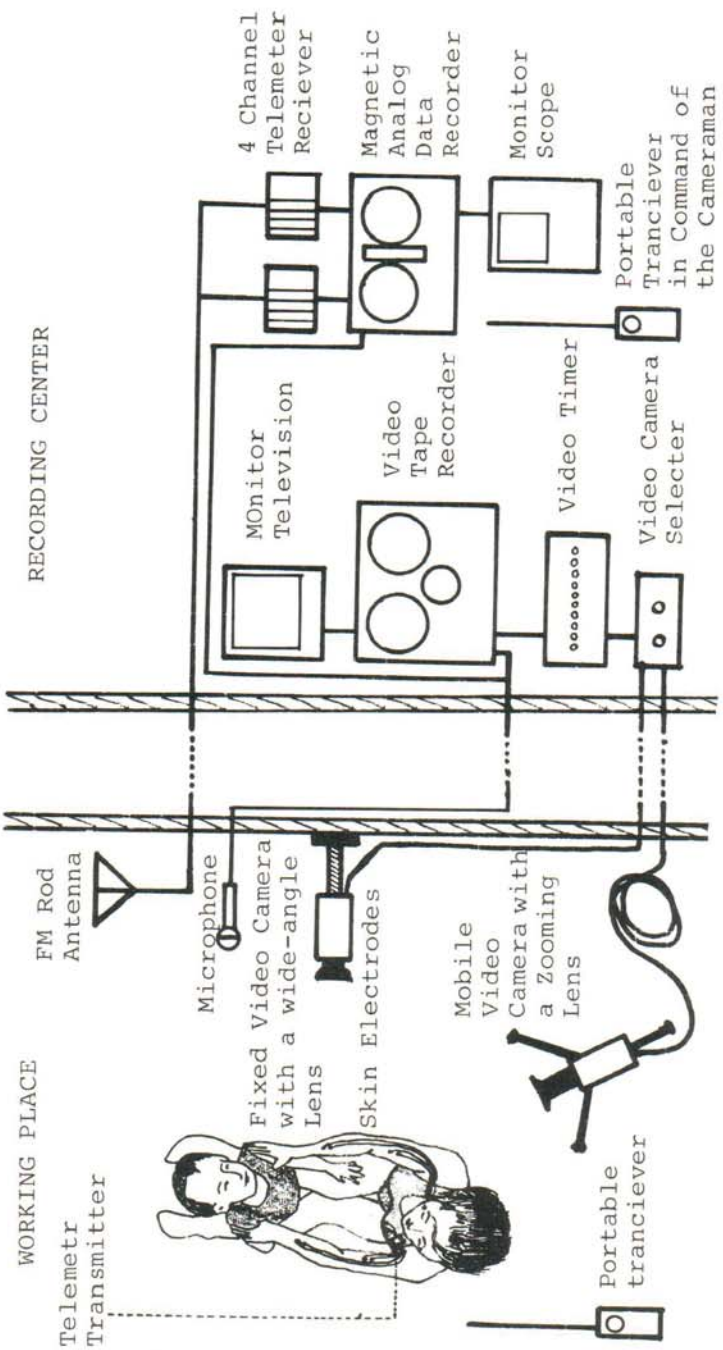


Fig. 1 – The work study system using the video tape-recorder and telemeters.

teachers). Teacher C was chosen for comparison with the other two teachers. All activities of the three teachers during ordinary working days were followed from November 1976 to March 1977 and recorded for two to three days in each institution by means of time lapsed video tape-recorder VTR (Matsushita Electric Co.) with a time marker. The sound in the working premises, heart rate, EMG and eye movement of the subjects were also recorded with a fixed microphone in the rooms and two multi-channel telemeters as shown in Figure 1. The analysis of the teachers' activities was made manually at one-second intervals according to the elements prepared in advance by regenerating the VTR at optimal speed. The activities were divided into (1) unit of work (14 units) (2) working posture (20 elements) (3) movement, chiefly bodily (15 elements) (4) movement, chiefly local (30 elements). A minicomputer (HP-2 100 A) was used for further analysis.

## RESULTS AND DISCUSSION

The activities of nursery teachers differ in countries with different social, economic, educational, cultural, and other conditions. The various activities of nursery teachers in Japan, being mainly due to the shortage of non-instructional staffs, can be divided into the following four categories: (1) giving lessons, (2) helping and preparing the children for lessons, feeding, excretion, bathing, and sleeping, (3) arrangements and rearrangements for the above mentioned activities, (4) doing jobs such as book-keeping, writing nursery diaries, holding meetings, cleaning, washing, and putting things in order. Thus we divided the activities into 14 units of work as listed in Table 4, and defined them more clearly by complementing each unit with 2 to 8 elements (59 elements in all).

The effect of the sampling interval on the work study was checked. Table 3 shows an example of time distribution of work units by systematic sampling at

TABLE 3
An example of time distribution of work unit by systematic work sampling at different intervals.

| Sampling interval (sec) | Sampling size | Work unit (in %) | | | |
|---|---|---|---|---|---|
| | | Giving lessons | Feeding | Help, care and arrangement for excretion | Cleaning and washing |
| 1 | 20 608 | 41.3 | 7.3 | 2.9 | 12.6 |
| 2 | 10 305 | 41.3 | 7.3 | 2.9 | 12.6 |
| 5 | 4 122 | 41.3 | 7.3 | 2.9 | 12.6 |
| 10 | 2 061 | 41.3 | 7.3 | 2.9 | 12.6 |
| 20 | 1 031 | 41.5 | 7.3 | 2.9 | 12.5 |
| 30 | 687 | 41.1 | 7.3 | 3.1 | 12.7 |
| 60 | 343 | 41.4 | 7.3 | 3.2 | 12.5 |
| 120 | 172 | 41.5 | 7.6 | 4.1 | 12.4 |
| 240 | 86 | 41.9 | 7.0 | 4.7 | 12.5 |
| 360 | 57 | 42.4 | 8.2 | 4.7 | 11.8 |
| 480 | 43 | 41.9 | 7.0 | 2.3 | 12.5 |
| 960 | 21 | 42.9 | 9.5 | 0.0 | 14.3 |

different intervals. The results indicate that the analysis of the nursery teachers' work by the systematic sampling at 120-second intervals is significant at the level of ± 2% absolute precision (95% confidence coefficient). Similarly, the analysis of their posture at 20 – 30 second intervals is found to be valid at the same statistical level. In the following analysis, however, one-second interval was used for the convenience of the analysis under various combination of factors such as work unit, spell of work, posture element, number of occurrences and others.

Table 4 shows time distribution by work unit in the three teachers. In teacher A, whose usual portal-to-portal time was eight hours, the total actual time analysed was two hours shorter than her actual working hours, because the children left the institution at 3:00 p.m. Teacher B was on an irregular shift

TABLE 4
Time distribution by unit of work of three nursery teachers (minutes).

| Unit of work | Teacher A* | Teacher B* | | Teacher C* |
|---|---|---|---|---|
| | Day duty | Day duty | Day and night duty | Day duty |
| 01 Help, care and arrangement for attending and leaving the institution | 27.3** | (—) | (—) | 1.9 |
| 02 Arrangement and rearrangement for lessons | 31.5 | 1.5 | 0 | 4.0 |
| 03 Giving lessons | 141.8 | 173.8 | 126.4 | 104.2 |
| 04 Help, care and arrangement before feeding | 10.4 | 26.8 | 38.0 | 35.0 |
| 05 Help and care for feeding | 28.4 | 57.0 | 59.8 | 53.5 |
| 06 Help, care and arrangement after feeding | 11.8 | 26.0 | 12.5 | 12.8 |
| 07 Help, care and arrangement for excretion | 13.5 | 49.7 | 63.7 | 65.5 |
| 08 Help, care and arrangement before and during napping and sleeping | (—) | 0 | 53 | 41.1 |
| 09 Help, care and rearrangement after napping and sleeping | (—) | 0 | 41.1 | 4.3 |
| 10 Help, care and arrangement for bathing | (—) | 0 | 31.5 | 0 |
| 11 Business, meeting, etc. | 18.6 | 33.2 | 32.2 | 55.2 |
| 12 Cleaning and washing | 21.1 | 56.8 | 71 | 24.0 |
| 13 Recess and time for personal needs | 33.4 | 53.4 | 62.3 | 74.2 |
| 14 Others | 0 | 20.4 | 572.6*** | 32.6 |
| Total actual time (minutes) | 337.3** | 498.5 | 1 164.0 | 508.1 |

* A = a teacher in a special class for mentally and physically handicapped children in a public primary school; B = a teacher in a public home for mentally handicapped children; C = a teacher in a public nursery school (cf. Method section). Abbreviations apply to all tables.

** Mean time of two days. Other figures are times of one day.

*** Includes time for watching and waiting (264 min.), dozing (282 min.) at midnight, and other activities (26.6 min.).

system. Teacher C took care of no handicapped children. With all the three teachers, the work for lessons (02 plus 03 in Table 4) occupied major portions of their working hours (2 to 3 hours) and the time for feeding (04 plus 05 plus 06) was about 50 minutes for each meal. The time required for other jobs varied from teacher to teacher.

The time necessary for frequent arrangements and rearrangements of tables, chairs, playing tools, etc. was also measured (Table 4), because in Japan in almost all institutions one room is usually used for many purposes. The lack of time for genuine recess and personal needs is one of the most serious complaints. According to our recent investigation, 50% or more workers had none or less than 15 minutes of the recess time every day.

The examples of posture analysis are given in Table 5 and 6. Cumulative time and frequency of posture of the three teachers differ from one another, reflecting the different conditions of the children, work contents, working environments, equipments, and their layout in each institution. The time and

TABLE 5
Cumulative time and repetition frequency of posture.

| Posture | Actual time (min.)/frequency (times) | | |
|---|---|---|---|
| | Teacher A | Teacher B | Teacher C |
| Standing, slightly bending forward | 84.0/574 | 172.9/650 | 112.7/842 |
| Deeply bending forward | 39.4/415 | 16.0/325 | 94.6/712 |
| Squatting | 6.5/137 | 37.4/157 | 9.4/148 |
| Rising on the knees | 41.7/270 | 9.6/160 | 23.3/169 |
| Sitting on the floor | 73.3/143 | 45.2/130 | 103.6/176 |
| Sitting on a chair | 19.4/15 | 44.7/26 | 0.9/3 |
| Other | 7.5/48 | 2.0/57 | 14.4/120 |
| Unknown | 31.7/133 | 101.1/297 | 42.3/180 |
| Total actual time (min.) | 303.9 | 428.9 | 401.3 |

*Excludes the time for recess and personal needs from the total actual time shown in Table 4.

frequency in a day or in each work unit of apparently unnatural and hazardous postures such as half-rising posture, rising on the knees posture and squatting posture are important for the evaluation of work load caused by working posture. As shown in Tables 5 and 6, the hazardous postures mentioned above appeared most frequently in teacher C (127 minutes) and least frequently in teacher B (63 minutes). The squatting posture was observed very often in the work of teacher B in nursing and helping children with excretion, and the rising on the knees posture was marked in the work of teacher A in giving lessons. On the other hand, standing and sitting postures can usually be considered as natural and easy. Nevertheless it is obvious that work load by these natural postures should be evaluated in relation to other factors. For example, 40% of standing and sitting postures of teacher A were accompanied by such movements as

TABLE 6
Time distribution of posture by unit of work.

| Posture | Teacher | Actual time (minutes) in each unit of work | | | | | |
|---|---|---|---|---|---|---|---|
| | | 02* + 03 | 04 + 05 + 06 | 07 | (10)** | 11 | 12 |
| Standing, slightly bending | A | 48.7 | 12.3 | 2.4 | (—) | 4.9 | 7.8 |
| | B | 79.2 | 57.5 | 17.3 | (9.8) | 0.7 | 17.1 |
| Deeply bending forward | A | 19.5 | 9.0 | 2.4 | (—) | 0.5 | 5.5 |
| | B | 4.2 | 4.1 | 0.9 | (12.0) | 0.2 | 6.5 |
| Squatting | A | 3.5 | 0.6 | 0.3 | (—) | 0 | 1.8 |
| | B | 10.5 | 4.5 | 18.8 | (7.3) | 0.2 | 2.9 |
| Rising on the knees | A | 30.9 | 1.4 | 2.6 | (—) | 0.1 | 2.1 |
| | B | 3.3 | 0 | 0.4 | (2.1) | 0.1 | 5.6 |
| Sitting on the floor | A | 53.4 | 11.5 | 0.5 | (—) | 2.7 | 0 |
| | B | 13.4 | 0 | 1.5 | (0 ) | 20.5 | 9.2 |
| Sitting on a chair | A | 1.1 | 9.0 | 0 | (—) | 9.0 | 0 |
| | B | 12.1 | 18.2 | 2.7 | (0 ) | 0 | 11.8 |
| Total actual time (minutes) | A | 173.3 | 50.7 | 13.5 | (—) | 18.1 | 21.1 |
| | B | 175.2 | 109.8 | 49.7 | (31.5) | 33.2 | 56.8 |

*The numbers are identical to the numbers of work units as shown in Table 4.
**Data of day and night duty analysis in teacher B.

holding or supporting a child in a certain posture. Thus, teacher A under these postures certainly performs hazardous static muscular work.

By analysing movements of nursery teachers we tried to find out aetiological factors of not only low back pain but also of the cervicobrachial syndrome. We set up 45 elements which are supposed to increase work load, local in particular, such as neck, shoulder and arms, as well as mental stress. The preliminary data are shown in Table 7. The difference in actual time and

TABLE 7
Cumulative time and repetition frequency of some movements.

| Movement | Actual time (min.)/frequency (times) | |
|---|---|---|
| | Teacher A | Teacher C |
| Holding up a child in arms | 20.1/85 | 32.2/163 |
| Holding up an unwilling child in arms | 0.1/2 | 2.9/42 |
| Touching a child | 111.0/309 | 119.2/648 |
| Touching an unwilling child | 1.1/6 | 23.0/369 |
| Being closely surrounded by children | 173.7/191 | 253.2/263 |
| Holding up or carrying an object (more than 1 kg) | 5.0/70 | 11 /128 |
| Holding up or carrying an object (less than 1 kg) | 62.5/239 | 57.4/318 |
| Total actual time (minutes) | 303.9 | 401.3 |

frequency between the two teachers is mainly due to the different conditions of children they were nursing. The two teachers spent 60% of total actual working hours closely surrounded by children, 30–37% of the time touching them, and 7–8% of the time holding them up in their arms.

## CONCLUSION

The work and work load were analysed in the nursery teachers in the institutions for the handicapped and healthy children. The application of a video tape recorder system[3] was of great help to the study. The results of work unit analysis revealed that nursery teachers spent 60–80% of their total working hours in non-instructional activities. No short recess except for the meal time was observed during the working hours, and the spell of actual work was considerably long. These undesirable conditions were mainly due to the shortage of non-instructional staffs, and partly also to the bad allotment of work and inadequate arrangements of the floor, equipments and other. The results of posture and movement analysis suggested that the physical and mental work load of the nursery teachers should not be neglected.

In this study, only a few cases were taken up and followed, but these cases seemed to represent the general conditions of almost all nursery teachers under the social welfare services of today's Japan. It is therefore expected that some measures for the reduction of the work load will be established shortly and that efforts will be made to prevent occupational health disorders in female workers.

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