

Comparative Analysis of Wheelchair Transfer Movements Between Nurse and Care Worker

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Abstract. It is considered that, even though it is for the same purpose, there is a difference in the methods of body position changing or wheelchair transfer between nurses and care workers. The authors had attempted in the previous study to develop a self-learning support tool for nursing students. As a part of the previous experiment, wheelchair transfer method discussed in the nursing technique textbook commonly used among nursing students was extracted. Then, this movement was filmed in order to produce an “example video”. We showed this “example video” to our test subjects consisting of care workers, and asked them to imitate the wheelchair transfer movement shown in the video. During this experiment, we received feedbacks from the test subjects that claimed; “We do not take this approach when transferring an elderly to and from a wheelchair in care work”. Even though care worker are all categorized as “care profession”, there are positions, such as Certified Care Worker and Certified Social Worker, that require national qualifications. There are also positions, commonly referred to care worker, that does not require any qualification. An unqualified care worker is required to receive the initial training seminar, and one of the professions that are qualified to become the instructor of this seminar is nurse. If there is a difference in the methodology between nurses and care workers, it means that the techniques taught by nurses were transformed through time in order to adapt to the environment of frontline care work. As movements involved in body position changing or wheelchair transfer are type of technique that is physically demanding and could potentially cause backache for both nurses and care workers, it is highly significant that the current technique is improved and becomes an easier technique for the practitioners. Therefore, in this study, we engaged veterans of both nursing and care work, measured their movement during body position changing and wheelchair transfer, and examined the characteristics of movements of each subject. In general, the location where a nurse conducts the movement in discussion is a hospital ward. On the other hand, it would normally be a facility such as a nursing home for a care

worker. Between a hospital ward and a care facility, there are many differences such as the legally required size of a room or the fact that one place is for medical treatment and the other is for living, resulting in dissimilarities such as the positioning of beds. By exploring the difference in the movement of nurses and care workers, while taking these factors into consideration, it is possible that improved methods for body position changing and wheelchair transfer that are better adapted to the environment could be devised.

Keywords: Wheelchair transfer · Nurse · Care worker · Nursing and nursing care

1 Introduction

In Japan, the population aged 65 or older reached a record high with 33.9 million as of October 1, 2015. The population aging rate—a rate of population aged 65 or older out of the entire population—reached 26.7% and this also set a record high [1]. Everyone hopes that elderly people live a long, healthy and autonomous life. However, it is not rare to find people who unfortunately cannot live life on their own terms due to illness or injury. World Health Organization (WHO) developed the concept of “healthy life expectancy” in 2000. The healthy life expectancy denotes a period in which a person can live a healthy, everyday life without receiving care or becoming bedridden, and the Ministry of Health, Labour and Welfare estimated it for the first time in 2010. In 2010 in Japan, the average life expectancy was 79.55 for men and 86.30 for women, and the average healthy life expectancy was 70.42 for men and 73.62 for women [2]. This means that males continue to live approximately 9 years and women approximately 12 years after they come to require care or become bedridden. Given the present circumstance in which the population that requires care increases while the population that provides care declines, nursing care issues for elderly people have gone well beyond individual or household problems; they have become social problems.

It is misleading to simply call elderly people who need care as such, since the degree of necessity differs from one individual to another; some people require simple assistance for their everyday lives while others require aid that falls under the category of medical treatment in addition to assistance for everyday lives. We may call the former as someone who requires simple nursing care and the latter as someone who requires both nursing and nursing care. Is it the nursing specialist or nursing care specialist who takes care of everyday lives of elderly people? The reason why this kind of question emerges is because difference in specialty between nursing and nursing care has not become clear, and their specialties are confused or are not properly understood in our society. If you are able to do nursing, you would be expected to be able to do nursing care, and you may say that it is hard to draw a clear boundary between their duties at a nursing home. What then is the difference between the nursing and nursing care?

Both roles have been carried out by specialists referred to by the name of the certified care worker (kaigo fukushishi) and the nurse (kangoshi) respectively. According to Ministry of Health, Labour and Welfare, the certified care worker is a

nationally licensed practitioner who uses the appellation “certified care worker” to engage in the business of providing care for a person with physical disabilities or mental disorder and intellectual disabilities that make it difficult to lead a normal life, and to provide instructions on caregiving to the person and the person’s caregiver based on Certified Social Worker and Certified Care Worker Act (Act No. 30 of 1987) [3]. On the other hand, the nurse refers to a person under licensure from the Minister of Health, Labour and Welfare to provide medical treatment or assist in medical care for injured and ill persons or puerperal women, as a profession, according to the Article 5 of Act on Public Health Nurses, Midwives, and Nurses (Act No. 203 on July 30, 1948) [4]. Thus the difference is clearly stated in the legal language. Furthermore, their difference can also be understood from the perspective of criteria for building training facilities. According to “Items concerning Campus and School Facilities and Facility Equipment”—which is building criteria for training facilities of certified care workers, “regarding educationally necessary equipment and instruments or models, prepare the following items and seek to enrich mechanical instruments for education according to new nursing care needs” [5]. To be more specific, items that must be prepared for education are: model dolls for practice, human skeletons, adult beds, transfer lifts, sliding boards or sliding mats, wheelchairs, simple bathtubs, stretchers, excretion tools, walking aid sticks, safety sticks for the blind, audiovisual equipment, cooking utensils for people with disabilities, dishes for people with disabilities, a set of Japanese futons, suction kits, feeding tube kits, medical tables or medical wagons, suction training model, tube feeding training model, cardiopulmonary resuscitation kits for practice, manikins. Compared with the criteria for building nurse training facilities [6], what certified care worker training facilities are obliged to be furnished with that nurse training facilities are not are: transfer lifts, sliding boards or sliding mats, simple bathtubs, walking aid sticks, safety stick for the blind, cooking utensils for people with disabilities, dishes for people with disabilities. It was found that the characteristic of those that are required for certified care worker training facilities and are not required for nurse training facilities is that they are mechanical instruments necessary for assisting a target subject for everyday move, everyday lives of having a meal or taking a bath. They are considered necessary tools for practicing skills that must be acquired in order “to perform nursing care for a person with disabilities according to his or her mental and physical conditions”, which gives a general idea about certified care workers as prescribed by the Certified Social Worker and Certified Care Worker Act. Basic education for nurses does not require learning how to use tilted equipment for nursing care. We can say that differing criteria for building training facilities also reveals difference in content of education between the nursing and nursing care. If you take a close look at the specific educational contents, you will find that there too is a clear difference. To take education of wheelchair transfer movement, which is mandatory as technical education for both nursing and nursing care trainees as an example, there is no section for a technique of transferring a patient using nursing equipment in 4 textbooks for basic nursing care techniques published by 4 major publishing companies and used generally by nursing training schools. It is sometimes included in a reference used as a supplementary reader, but the so-called “textbooks” generally include only the method of transferring a patient to a wheelchair using body

mechanics. On the other hand, the transfer method taught to certified care workers differ from the method taught to nurses. Although this depends on the textbook, one example is a certified care worker transferring a person in need of care to the wheelchair by kneeling down on the floor. Nurses have never been taught such a method.

Secondly, if you look at the criteria for allocating personnel for building nursing-care insurance facilities, the number ascends in the order of doctors, nurses, and certified care worker. To put it in an extreme way, even if there were 40 doctors, they would not be able to take care of everyday lives of persons in need of care due to an increase in labor costs. Although nurses can take care of everyday lives of them just as do certified care workers, this too is not a realistic option seen from the perspective of labor costs. According to the 2015 Basic Survey on Wage Structure released by Ministry of Health, Labour and Welfare, the average age of nurses is 38.2 years old and their average salary is 329,200 yen, while the average age of certified care workers is 39.7 years old and their average salary is 223,500 yen [7].

There is a preceding study that attempted to reveal through an interview how nurses and certified care workers who were working in the same facility perceived specialty of each other, in order to delineate confusions of specialty for nursing and nursing care. There, it was found that they raised as specialty for nursing “health management”, “health assessment”, “medical care”, and as the specialty for nursing care. “accepting resident’s life at home as such regardless of clinical condition”, “appreciating what the resident believes”, etc., and it centered on helping a resident to live a well-organized everyday life in line with resident’s thoughts and feelings [8]. This study was an attempt to mutually understand their professions and clarify their roles within a facility to provide better living to people in need of care. This study is considered to involve an objective to positively clarify specialty of the nursing care and the nursing.

As seen above, the difference in specialty between nursing and nursing care has been revealed from the difference in educational curriculum, criteria for building facilities, etc. Nevertheless, similarity in skills demonstrated by them leads to confusion of their specialties. However, few studies have mentioned detailed difference in skills between them as a matter of fact. Therefore, this study takes “wheelchair transfer”—which is an univocal expression expressed by both nursing and nursing care—as an example, in the aim of revealing whether true difference is manifested in behavior between them. Study participants in this experiment are a skilled nurse who had experience of using sliding boards at hospitals, but never had hands-on experience at nursing homes, and a skilled certified care worker who was working at a nursing home as a care worker. They were asked to transfer a participant from a wheelchair to a bed using a slide board, which was typically developed to help a single caregiver with transferring a subject. Their movements were recorded using motion capture, and their difference was examined using three dimensional data. Furthermore, a series of movements was filmed using a video camera, and the difference in movements and duration of transferring was visually checked. Movements were classified into movements common to them, movements differing between them, and characteristic movements for discussion to reveal the difference between the nursing and nursing care.

2 Methods

2.1 Participants

The skilled certified care worker had 8.5 years of experience, was 165 cm tall, weighed 68 kg, was aged 35, with 8.5 years of experience of using the slide board. The skilled nurse had more than 20 years of experience (never had experience of working at a nursing home), was 164 cm tall, weighed 52.5 kg, was aged 48, with several times of using the slide board.

2.2 Procedures

The study certified care worker was asked to transfer a model that mimicked a person in need of care, and the study nurse was asked to transfer a model that mimicked a patient, from a wheelchair to a bed. The person in need of care and the patient were asked to sit in a wheelchair, and the certified care worker and the nurse were asked to transfer respectively the person in need of care and the patient who were both seated in a wheelchair to a bed using a sliding board.

A sliding board is a welfare device used to transfer a person in need of care or a patient from their wheelchair to a bed, car, portable toilet, etc. Sliding boards are either made of woods or plastic, and they are generally slippery on the top side and non-slip treatment is done on the back side. A sliding board can be used for transfer assistance for even those who have difficulty standing up, maintaining a standing position, or changing the direction, as long as they can adopt a sitting posture. Because it is a welfare device that allows a caregiver to achieve the purpose by shifting the subject's center of gravity without the caregiver lifting a person in need of care or a patient who cannot stand up, it is said to reduce strain put on the caregiver [9]. Both caregivers were asked to repeat the above movement several times.

2.3 Recording Procedures

The assisting movement was filmed using a digital video camera. Simultaneously, an optical motion capture system—MAC3D SYSTEM (a Motion Analysis product) was used to measure coordinates of each marker. Sampling frequency was set to 120 Hz. Infrared reflective markers were attached in 25 sites of the entire body of the certified care worker, 26 sites of the entire body of the nurse, 7 sites on head and shoulders of the person in need of care who was assisted by the certified care worker, 21 sites on the entire body of the patient who were assisted by the nurse, 8 locations of the wheelchair. As for the coordinate system, the horizontal direction from the study participant was plotted on x-axis, the front-back direction was plotted on y-axis, and the vertical direction was plotted on z-axis.

3 Results

3.1 Movements of Certified Care Worker

The standing position at the beginning of the movements was in front of the wheelchair in which the person in need of care is seated (Fig. 1). The certified care worker removed armrests on both sides of the wheelchair before he started transferring the person in need of care (Fig. 2).



Fig. 1. Standing position of the certified care worker before beginning the movement.

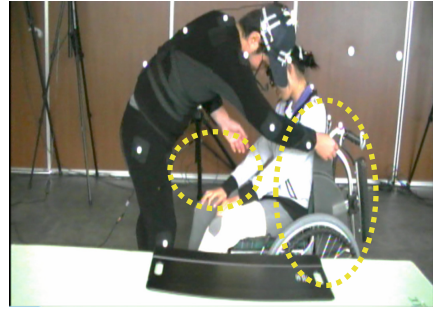


Fig. 2. The position of armrests.

The certified care worker had the person in need of care shift to the front half of the seat by having him vertically shift his weight on the wheelchair seat. On this occasion, the certified care worker adopted a posture as if he placed himself over the top of the person in need of care, first supporting the buttocks of the person in need of care, and having him transfer to the front half of the seat while vertically shifting the weight of the person in need of care (Fig. 3).

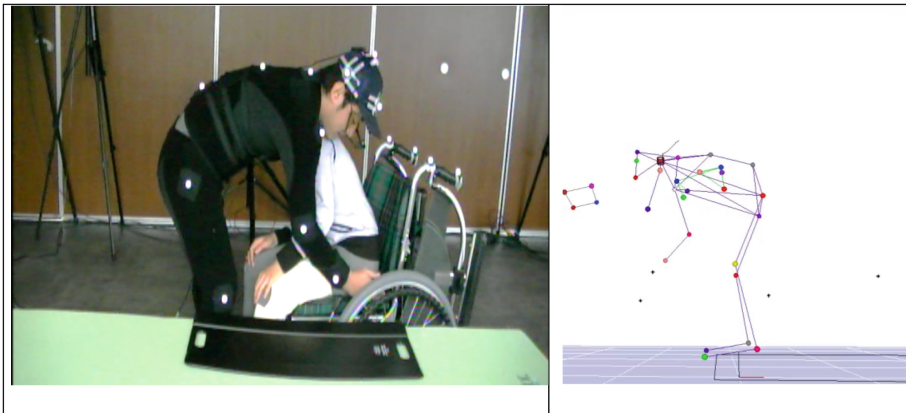


Fig. 3. The certified care worker transferring the person in need of care to the whole area of the seat-1.

Afterwards, the certified care worker located his finger tip in the direction of the floor side, inserting the arms to the direction of armpit from the backside of the person in need of care, and moving the person in need of care to the assumed position (Fig. 4).

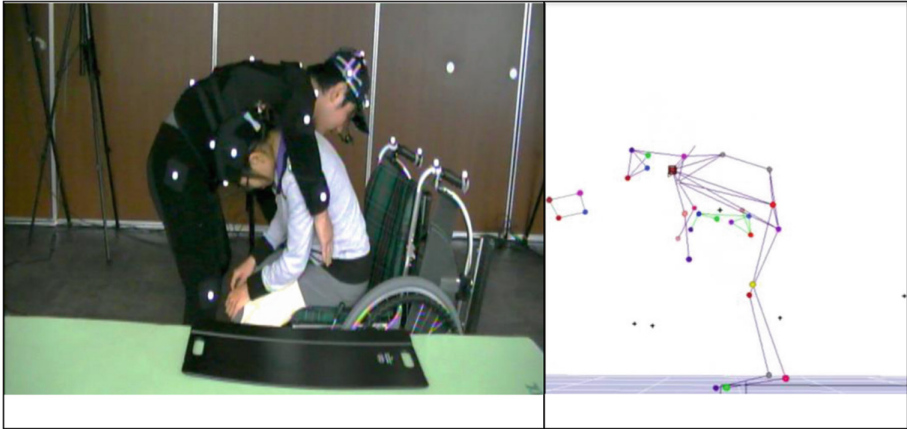


Fig. 4. The certified care worker transferring the person in need of care to the whole area of the seat-2.

The certified care worker knelt down on side of the knee opposite to the side of the transferring bed, stretched arms from the chest side to the side of the armpit to which the person in need of care would be tilted, supported and tilted the person in need of care, and inserted the sliding board underneath the lifted buttock on the side opposite to the tilted side (Fig. 5). The tilted angle of the person in need of care was X-Z plane 45.2° X-Y plane 40.5° . On this occasion, the brake lever of the wheelchair which would get in the way was removed.

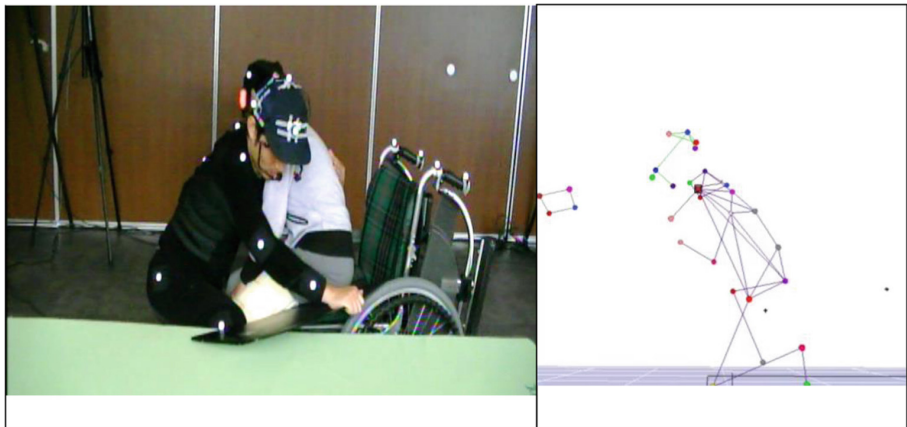


Fig. 5. The certified care worker insert the sliding board.

The certified care worker released the arm inserted in the tilted-side of the armpit of the person in need of care, and inserted the other arm in the opposite side of the armpit—which is a moving direction of the person in need of care—in the similar manner, and placed the released arm on the iliac region of the person in need of care, pushed him using the arm, tilted his body, and slid him on the sliding board to transfer him to the bed. (Fig. 6) On this occasion, the body of the person in need of care was rolled largely toward the moving direction. Furthermore, the face of the person in need of care was positioned in the moving direction, and the face of the certified care worker was positioned in the opposite direction from the forward direction. The certified care worker slid the person in need of care on the sliding board as if rotating him around an axis. After having finished sliding, the sliding board was pulled off in a series of movements (Fig. 7).

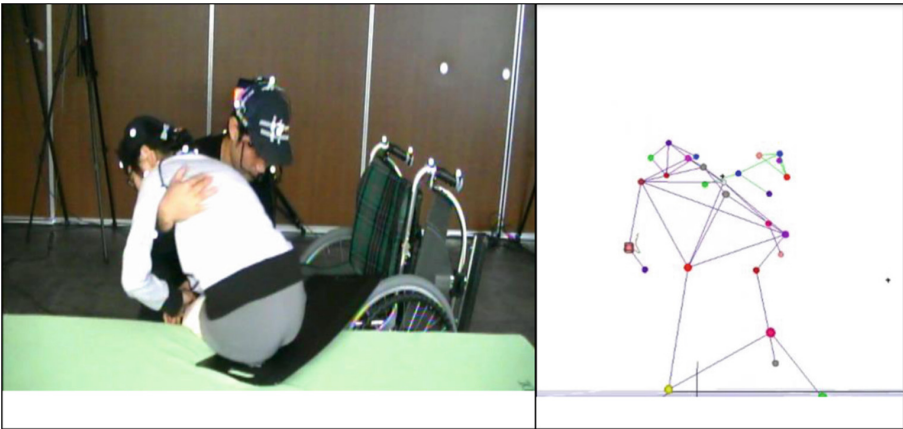


Fig. 6. The certified care worker sliding the person in need of care on a sliding board.

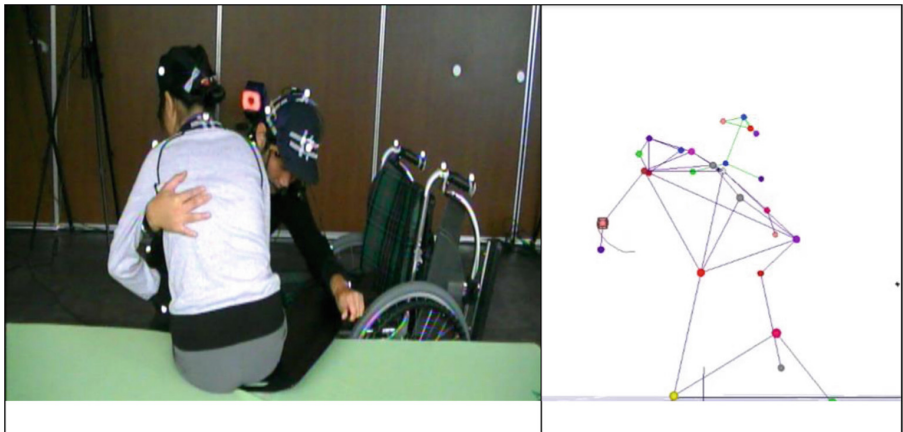


Fig. 7. The certified care worker pulling off the sliding board.

3.2 Movement of the Nurse

The standing position before beginning the movement was in front of the wheelchair in which the patient sat. Before beginning the transfer of the patient, only the armrest on the moving side of the patient was removed (Figs. 8 and 9).

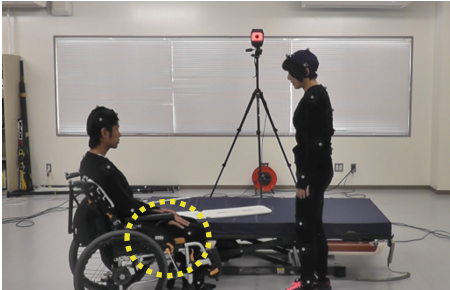


Fig. 8. Standing position of the nurse and the position of armrests 1.

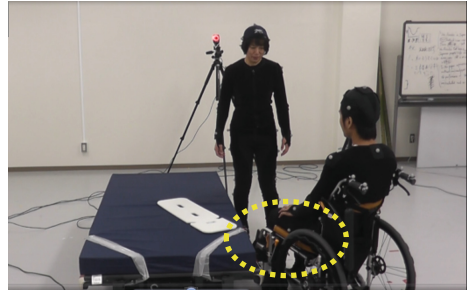


Fig. 9. Standing position of the nurse and the position of armrests 2.

The nurse had the buttocks of the patient keep in the same position as when he sat on the wheelchair for the first time, rolled the patient on the seat while the nurse himself remained standing, slid a sliding board underneath the lifted buttock (Fig. 10). The nurse rolled the patient by pushing up the side of the buttock he wanted to lift. The patient tilted 19.2° to the X-Z plane and 37.1° to the X-Y plane. The brake lever of the wheelchair remained attached.

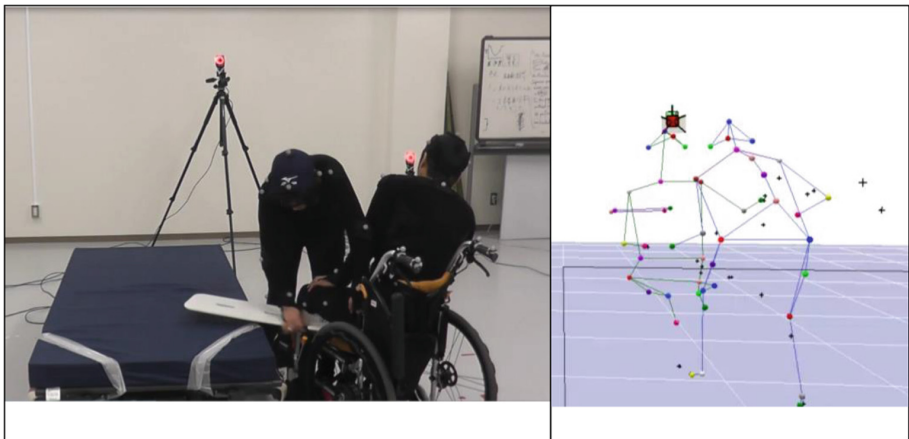


Fig. 10. The nurse insert the sliding board.

The patient put his arms around the neck of the nurse, and the nurse supported the back of the patient and moved his body upward to let his body stand up once, and then slid him on the sliding board. The upper body of the patient was hardly leant. At this

time, the face of the nurse was oriented toward the moving direction of the patient (Fig. 11). After having finished sliding, the sliding board was pulled off in a series of movements (Fig. 12).

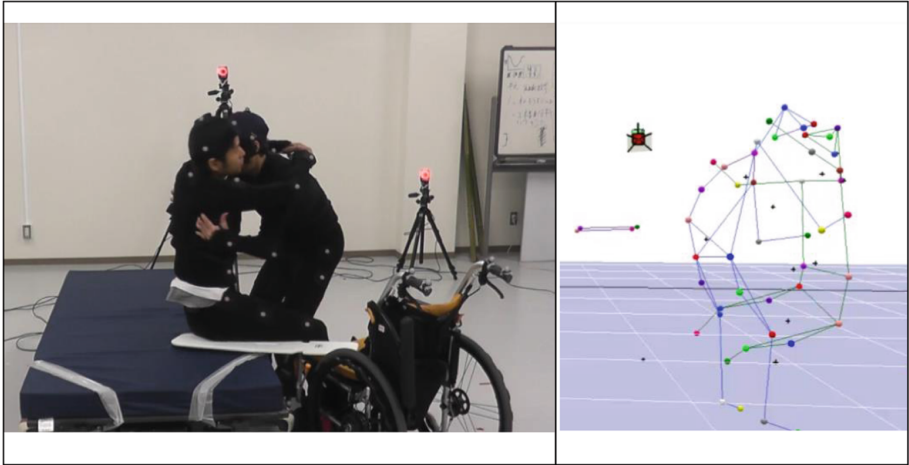


Fig. 11. The nurse sliding the patient on a sliding board.

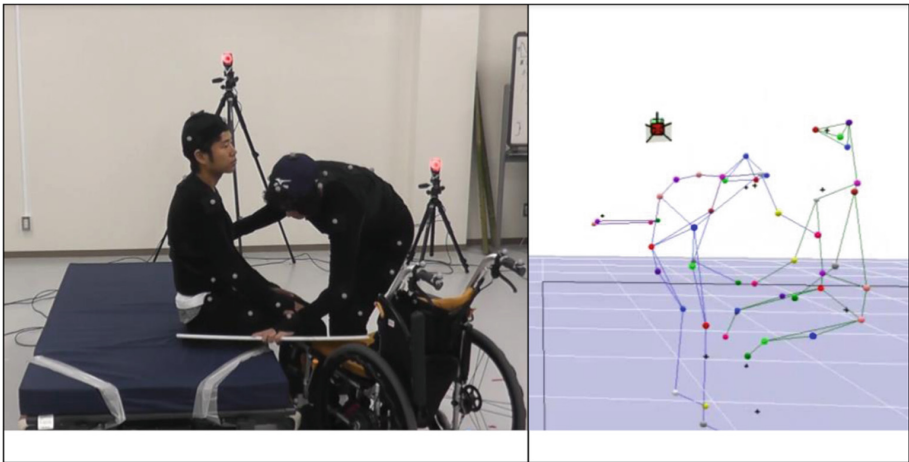


Fig. 12. The nurse pulling off the sliding board.

4 Discussion

Both certified care worker and the nurse have tried to begin movement by standing in front of the subject seated in a wheelchair. As a preparation before beginning transfer assisting movement, the certified care worker removed armrests on both sides of the

wheelchair, while the nurse removed only the armrest in the moving direction of the patient. This seems to be because the certified care worker thought armrests would get in the way as he moved the person in need of care to the front half of the seat in the subsequent movement. This can also be explained by the fact that basic nursing education teaches students not to remove safety devices to secure the maximum patients' safety, so he might thought that if, unlike the certified care worker, it is not necessary to change the sitting position of the patient on the wheelchair seat, it is not necessary to remove armrests—safety devices. Furthermore, because basic nursing education teaches students to maximally use remaining functions of patients to prevent disuse syndrome, if the upper limb movements can be performed well, the transfer method of the patient herself holding armrests to support her own body while transferring from the wheelchair will be selected in line with, even if the lower limbs are weakened to the point of requiring a wheelchair. Thus, we can conclude that the nurse did not have to remove the armrest because he thought not doing it would not interrupt the assisting movement.

Secondly, the certified care worker moved the sitting position of the person in need of care in order to make it easy to insert the sliding board below the buttocks of the person in need of care. This is a transfer method in which the caregiver rolls the person in need of care to the left and to the right several times to reduce the area on which the buttocks of the person in need of care rest and to transfer her while minimizing friction. This method is considered reasonable and has also been incorporated for nursing care as it makes it easy to transfer a heavy subject. However, if you look at Figs. 3 and 4, the certified care worker bent his back considerably to adopt a forward head posture, and inserted arms from the back of the person in need of care to perform the movement. Thus, from the principles of body mechanics, this movement can be said to strain the body of the caregiver. The principles of the body mechanics require that they apply mechanics to human beings to perform safe, efficient or effective tasks. They involve techniques of human motions, movements with regard to postures and its sustenance, by applying mechanical principles to physical sites such as arms and legs, elbows and knees, backbone, etc. In the nursing or nursing care field, they involve a technique of reducing strain of the caregiver, and of preventing back pain, etc. [10]. One of the important elements of body mechanics is to allow wider room for the base of support and to lower the center of mass in such a way that the center of mass is positioned within the base of support in order to stabilize the body of the caregiver. Moreover, it is important to efficiently use force. The posture and movements of the caregiver when transferring a subject require lumbar discs to have greater load bearing capability. If, however, force is used efficiently, the object of the same weight can be moved and carried with lesser effort, and the strains on the body will be reduced [11]. The certified care worker adopted a forward head posture by bending his spine at the lower back. This is a posture that increases load on the spine in the musculoskeletal system. The erector spinae that surrounds the vertebral column cannot bear bigger load imposed when transferring the body of a person, and adoption of an inappropriate working posture to lift a weighty object tends to lead to unequal distribution of mechanical loads to the intervertebral disc, which increases the risk of back problems. No such posture was observed in the movements of the nurse. It is often said that care workers are suffering low back pain, and it is necessary to review the posture they adopt when providing care.

Before performing the movement of inserting a slide board beneath the buttocks of the person in need of care, the certified care worker knelt on the floor (Fig. 5). To explain this from the principles of body mechanics, kneeling on the floor broadens the area of the base of support and stabilizes the center of mass of the certified care worker. This enables both the certified care worker and the person in need of care to perform safer and easier transfer movement. Transferring a person in need of care by kneeling on the floor is mentioned in a textbook of nursing care techniques [12]. On the other hand, the nurse performed all transfer movements from the beginning to the end of the movements while standing. This is due to the fact that basic nursing education or hospital rule mandates treating a space within 20 cm from the floor as a dirty space [13]. For this reason as well as from the perspective of prevention of hospital infection, the nurse did not have the idea of kneeling on the floor, and he will not adopt the method, however broader the base of support can become.

When the certified care worker inserted a sliding board beneath the buttocks of the person in need of care, the tilted angle of the person in need of care was 45.2° to the X-Z plane and 40.5° to the X-Y plane. The nurse tilted angle of the patient was 19.2° to the X-Z plane and 37.1° to the X-Y plane. The certified care worker tilted the body of the subject greater than did the nurse. Although tilting the subject to a greater degree will increase the risk of falling, it reduces the area that the buttocks touch on the seat of the chair, allowing a caregiver to insert the slide board more deeply. The larger the area of the sliding board inserted, the lesser the strain that the sliding movement puts on the body of the caregiver. Even though both the certified care worker and the nurse performed movement to roll the subject, there was a large difference in their tilted angles. We suspect that this difference arose from the difference in ADL (Activities of Daily Living) of subjects that they are normally taking care of. It is assumed that the smaller the level of autonomy in ADL of a subject, the greater the caregiver suffers from strains. Moreover, if it is necessary to assist a subject by a caregiver alone, it is necessary to obtain a method that would not strain the body of the caregiver. In case of a nurse who works at a hospital, it is easy to assemble human resources when transferring a patient from a wheelchair. By contrast, in case of a certified care worker who often does it alone in a nursing home or in a nursing care situation, it is considered that the best method they came up with from their circumstances was to tilt the person in need of care as much as possible and to insert the sliding board. The same goes for the method they acquired of assisting a subject by means of kneeling on the floor as mentioned above.

In the movement of sliding the subject on the sliding board, the face of the person in need of care was oriented toward the moving direction, and the face of the certified care worker was positioned more distant from the moving direction than that of the person in need of care. On the other hand, the face of the nurse was positioned to see moving direction of the patient. The nurse confirmed safety of the transfer position, by visually checking the moving direction of the patient. In the movement of the certified care worker sliding the person in need of care on a sliding board, the certified care worker looked like transferring the person in need of care by utilizing the momentum created when the person in need of care fell to the moving direction after the certified care worker inserted and tilted a board to the same or even a greater degree than the degree by which the person in need of care was tilted, in contrast to the nurse sliding the upper body of the patient without tilting it. If this method is employed, it is

necessary to orient the face of the person in need of care toward the backward direction. Moreover, tilting the person in need of care reduces the area that hips of the person in need of care touches on the sliding board, thus reducing friction and making it more slippery. Furthermore, the person in need of care who was about to be transferred on a sliding board would feel safe if he were able to see the moving direction. We assume that this difference between them has arisen out of difference in facilities where their specialties have been exercised. At a hospital, it is necessary to transfer a patient who is put on a drip or is inserted a catheter in a safe manner. If the patient has reduced ADL, it is necessary to ensure safety by transferring the patient through the hands of multiple nurses. By contrast, the second priority of the certified care worker—provided that he is able to confirm the safety of the moving destination of the person in need of care in advance to beginning the movement—is how the certified care worker can transfer the person in need of care by himself without straining his body. Because it is impossible for certified care workers to request assistance of others in nursing care like situations and nursing facilities require transferring many persons in need of care, the industry suffer a persistent lack of human resources and certified care workers often need to assist transferring a subject alone. Thus, protection of health of the certified care workers is prioritized.

Finally, no big difference was found between the certified care worker and the nurse concerning the movement of pulling off the sliding board.

5 Conclusion

This study was premised on the fact that due to similarity of skills exercised between the certified care worker and the nurse, their specialties were confused and thus it attempted to reveal the difference in skills between the certified care worker and the nurse. The movements of transferring from a wheelchair performed by both the certified care worker and the nurse were taken as examples to examine if there is a genuine difference in their movements. It was found that there was a clear difference in their movements. The fact that the difference emerges in educational curriculums that train personnel in each specialized field, and the difference in circumstances in which the wheelchair transfer skills are primarily exercised, and the difference in subjects of being transferred from the wheelchair are considered factors that gave rise to this difference. They are the same in that they developed a method that would not strain body of the caregiver themselves and that they performed movement while ensuring safety of their subject. In hospitals, however, there are regulations to prevent hospital infection, and treatment will be prioritized for a patient, there are cases where a nurse assisting transfer of a patient alone is deemed inappropriate. In case of certified care workers, a certified care worker will often encounter situations of transferring a person in need of care from a wheelchair alone, so as to make up for the lack of human resources. This is true even if the person in need of care has reduced ADL. In such a case, the priority is to select movement of transferring the subject without straining the body of the certified care worker. One useful method for a certified care worker is to kneel on the floor to transfer the person in need of care. From these considerations, we think we have successfully revealed the difference in specialty between certified care workers and nurses.

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