



## Checkout cashier work and counter design – Video movement analysis, musculoskeletal disorders and customer interaction

Annika Kihlstedt<sup>a,\*</sup>, Göran M. Hägg<sup>a,b,c</sup>

<sup>a</sup> Department of Work and Health, National Institute for Working Life (now closed), Stockholm, Sweden

<sup>b</sup> Centre for Musculoskeletal Research, University of Gävle, Gävle, Sweden

<sup>c</sup> Department of Ergonomics, School of Technology and Health, KTH Royal Institute of Technology, Stockholm, Sweden

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### ABSTRACT

This study was conducted in order to analyse checkout cashiers' movements at a checkout counter during interaction with customers and the prevalence of work-related stress and musculoskeletal disorders in checkout cashiers. In one shop, six cashiers were videotaped during the workday, and 50 cashiers from seven shops from the same chain of stores responded a questionnaire. Cashier activities and movements, customer interaction and counter design issues were analysed from the video data. Prevalence of work-related stress and musculoskeletal disorders was obtained from the questionnaire. It was found that 76% of all items were manually turned or angled. With a better adjustment of the scanner and a standardised positioning of the EAN-code, many of these movements could be avoided. Furthermore the prevalence of musculoskeletal disorders was quite high (68% for the neck). The questionnaire results showed that many cashiers experienced stress, giving a high percentage of cashiers in the "dedication under pressure" group. The behaviour of the customers was the major cause of stress. Other sources of stress arose from bad design or function of the computer system or other technical equipment. *Relevance to industry:* In this study several problems regarding cashier work were identified and solutions, relevant to counter and package designers, shop managers and cashiers are suggested. Data obtained on cashier movements and prevalence of musculoskeletal disorders are given.

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### 1. Introduction

The design of a checkout counter has an impact on a cashier's work environment, directly and indirectly by influencing customer behaviour. Checkout cashier work has been associated with high rates of disorders in shoulder/neck as well as hand/arm (Baron and Habes, 1992; Harber et al., 1992; Lundberg et al., 1999). A more or less continuous flow of items to check and manipulate constitutes highly repetitive work, often done in short work cycles. Such work is associated with a high risk for musculoskeletal disorders (MSD) (e.g. Buckle and Devereux, 2002). Extensive measurements of identified risk factors like wrist angle, wrist angle velocity and forearm muscle load in a large variety of occupations, however not checkout cashiers, have been performed by Hansson et al. (2009). Their results indicate large variations in exposure, even within the same occupation.

Detailed analysis of work movements and their relationship to checkout counter design were performed previously (Grant et al., 1994; Grant and Habes, 1995; Hinnen et al., 1992; Baron and Habes, 1992). However, the fast technical development of checkout systems has since changed the work flow. Furthermore, large differences in counter design and customer habits can be seen between different countries and continents. In the Nordic countries today, a fairly standardised design dominates (see Fig. 1 and Method section). This counter type is referred to as the Nordic counter in this paper.

Several new checkout concepts have been introduced recently, like self-scanning by the customer which eliminate ordinary cashier work. However, according to several representatives for the retail trade, traditional checkout cashier work will likely be the dominant way of payment control for a long time in the future.

The Nordic counter has been studied in relation to physiological responses to physical demands and stress, measuring muscular tension (EMG) and hormone secretion (Lannersten and Harms-Ringdahl, 1990; Rissén et al., 2002). However, as far as we know, a detailed systematic analysis of cashier work movements in relation to customer behaviour and counter design has never been performed.

\* Corresponding author. Innventia AB, Box 5604, SE-114 86 Stockholm, Sweden. Tel.: +46 8 676 70 00; fax: +46 8 411 55 18.

E-mail address: [annika.kihlstedt@innventia.com](mailto:annika.kihlstedt@innventia.com) (A. Kihlstedt).

The aim of the present study was to analyse cashier work movements in relation to the Nordic checkout counter design as well as to the interaction with customers. A second aim was to get an updated picture regarding MSD prevalence and experienced stress by the checkout cashiers.

## 2. Methods

Two methods were used in this study. Video recordings were analysed for work activities and movements; and a questionnaire on MSD prevalence and experienced stress was answered by 50 cashiers.

### 2.1. Subjects

For the video study six experienced cashiers volunteered, four women and two men, all right-handed. The age range was 18–25. The women's median height was 168 cm, range 165–175 cm, and the men's median height was 177.5 cm, range 175–180 cm.

Before the recordings all cashiers read instructions explaining the purpose of the study and that personal data would be seen by the investigator only and not shown to the employer or to the public. They were also informed about their right to leave the investigation at any time without any explanation. An information poster at the entrance of the checkout counter informed the customers about the ongoing project and that their hands might be seen on the video recordings.

For the questionnaire part of the study, 50 cashiers participated of which 28 were women, 21 were men and one cashier for which information about sex was missing. Relevant data for this group are shown in [Table 1](#).

### 2.2. Shop and checkout counter

The studied shop belonged to a chain that offered groceries and everyday commodities. It had a low price profile and a relatively small assortment of items. The shop was of medium size and located in a metropolitan area in Sweden.

The checkout counter was of a standard Nordic type established on the market since 2003. It had long input and output conveyor belts and two output bins. The cashier faced the customer. A cash box, display unit, keyboard, and a rolling scale were in front of the cashier. The rolling scale was at the same height as the two conveyor belts (see [Figs. 1 and 2](#)).

Counters with both a left-to-right and a right-to-left flow of items were used in the shop. For practical reasons, a counter with a right-to-left flow as seen from the cashier's perspective was selected for the video study.

### 2.3. Video recordings

A video camera was mounted above the head of the cashier facing down to show the cashier's working area (see [Fig. 3](#)). This view usually excluded the customer but occasionally the customer's hands were seen during the payment transaction. The



**Fig. 1.** Checkout counter of Nordic type viewed from output side.

video recordings were made during a typical workday with a continuous or almost continuous customer flow. Each cashier was recorded for 35–43 min.

Parallel to the video recordings, systematic observation of customer behaviour was carried out by the experiment leader. The observations were documented in a paper protocol and were synchronised with the timing of the video recordings. Notes were taken on the following: start and end time for each purchase, number of persons per purchase, payment method, whether or not the customer took the receipt, cashier giving purchased items directly to customer and other events of interest that arose. After each recording the cashier filled in a short questionnaire to document any unusual events or unusual customer behaviour during the recording period.

### 2.4. Video analysis

Each video recording was observed several times, each time focusing on different events. The computer programme PEO (Portable Ergonomic Observation ([Fransson-Hall et al., 1995](#))) was used to register the observations. The programme yielded event frequencies, durations and accumulated durations, calculated from data input by the observer using predefined keys on the computer keyboard. The choice of keys was customized for our purpose. The



**Fig. 2.** Checkout counter of Nordic type viewed from input side.

**Table 1**  
Background data for the questionnaire respondents,  $N = 50$ .

	Median	Range
Age	22	18–47
Worked hours per week	15	4–30
Time of employment, months	7	0–18
Experience as cashier, months	17	1–234
Right-handed, %	84	–

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