

SHIFTWORK IN SINGAPORE

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ABSTRACT

In 1985, over 94,000 persons were engaged in shiftwork. With the continued emphasis on capital-intensive industries and growing demand for "round-the-clock" services, shiftwork is increasingly becoming an economic necessity in many industries in Singapore.

A survey in 1991 confirmed this trend. The study covered 4,996 private sector establishments employing 25 or more paid employees. 34.4% of the establishments had shiftworkers. In terms of employees, 32% or 206,965 employees were working shifts. While the 8-hour shift schedule was still the predominant pattern, there was a ten-fold increase in the number of 12-hour shiftworkers. A trend towards permanent shift schedules was also noted. It was interesting that the proportion of shiftworkers doing nightwork decreased to 36.9% from 45.1% in 1985.

The health implications of shiftwork have been widely reported. So far, our own studies indicate no serious long-term health effects among shiftworkers. However, further studies are needed to determine if preventive measures can be taken to minimise the common complaints of sleep problems and tiredness, particularly among rotating shiftworkers.

Keywords: Shiftwork, Singapore.

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INTRODUCTION

In recent years, Singapore has placed considerable emphasis on capital-intensive industries. High investment in machinery and the widespread introduction of continuous process operations make it necessary to maximise productivity by minimising "downtime". At the same time, with increasing affluence, there is a growing demand for the provision of "round-the-clock" services, such as transportation, security, medical care and retail.

Consequently, shiftwork is increasingly becoming an economic necessity for many industries in Singapore. With the increase in shiftwork, there will understandably be a concern regarding the possible health implications for the shiftworker.

In 1985, over 94,000 persons worked on shifts, representing 14% of all employees in firms with 10 or more paid employees⁽¹⁾. The objective of the present study is to document the current extent of shiftwork in Singapore. Such information is useful, not only to those concerned with the health of our workers, but also to sociologists, economists and health planners.

METHODS

The questionnaire survey covered all 5,588 private sector establishments employing 25 or more paid employees, based on Central Provident Fund records as at June 1991⁽²⁾. At that time, there were 71,616 private sector establishments in Singapore, employing a total of 1,061,181 persons. The response rate for the survey was 97%. Of the 5,429 establishments that responded, 4,996 were active firms employing a total of 645,867 employees. The findings reported refer to these active establishments. The reference period was as at end June 1991.

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Where possible, the current findings are compared with those of the earlier study conducted in 1985. Both surveys covered universe populations based on listings from Central Provident Fund records⁽²⁾. However, unlike the present study, the 1985 survey covered establishments with 10 or more paid employees. To adjust for this discrepancy, the "most conservative estimate" approach was used in making comparisons between the two surveys, ie it was assumed that all shiftwork reported in the 1985 survey was contributed by the "larger" establishments (defined as those with 25 or more employees). If, in fact, some of the shiftworkers in the 1985 study did come from establishments with 10 to 24 employees, this approach would result in some degree of under-estimation of the difference in shiftwork prevalence between the two periods. However this under-estimation is not expected to be considerable.

To use this approach, estimates were first made of the numbers of firms and employees respectively, in the 1985 survey, that were from the "larger" establishments. These estimates were based on the actual proportions of firms and employees respectively, in the "larger" establishments category, obtained from the Central Provident Fund records as at the time of the survey⁽²⁾. These records showed that 41.8% of firms with 10 or more paid employees belonged to the "larger" establishments category, ie they had 25 or more employees. In terms of employees, the proportion was 84.3%.

Thus, it was estimated that 3,661 or (41.8%) of the 8,758 firms covered in the 1985 survey were the "larger" establishments, and 566,105 (or 84.3%) of the 671,536 employees covered were from these "larger" establishments. Using the same basis, estimates were derived (again based on actual distributions obtained from the Central Provident Fund records) of the number of firms and employees by industry that were covered in the 1985 survey within the "larger" establishments category (Table I).

The Chi-square test was used to determine the statistical differences between proportions. In addition, the 95% confidence interval of the difference between proportions was reported, as appropriate⁽³⁾.

RESULTS

Establishments with Shiftwork

One thousand seven hundred and seventeen (or 34.4%) of the establishments had employees engaged in shiftwork, compared

Table I – Estimated Distributions by Industry of Establishments and Workers in the “Larger” Establishments Category (1985)*

Industry	No. of Establishments	No. of Workers
Manufacturing	1,153	213,422
Commerce	854	101,082
Transport	240	53,218
Finance	556	64,030
Service	247	64,069
Others	611	70,284
Total	3,661	566,105

*: Figures refer to the numbers of establishments and workers estimated to have been covered in the 1985 study under the category of establishments with 25 or more workers.

to 1,051 (or 12%) of establishments reported in 1985, or 28.7% using the “most conservative estimate” approach, ie, assuming all 1,051 firms with shiftworkers came from the estimated 3,661 “larger” establishments. The increases were statistically significant in both comparisons ($p < 0.001$).

As in 1985, the manufacturing and commerce sectors together accounted for the majority (71.5%) of the establishments with shiftworkers (Table II). In terms of prevalence of shiftwork by industry, the manufacturing, commerce and service sectors still had the highest proportions of establishments with shiftwork. The manufacturing and finance sectors showed significant increases in the proportion of firms with shiftwork ($p < 0.001$ and $p < 0.01$ respectively). In addition to determining absolute changes in industry prevalence,

the relative magnitude of these changes was obtained to facilitate direct comparisons across industries. This was done by computing the “relative percent difference” for each industry using the 1985 prevalence as base 100%. The highest relative increases were found in manufacturing, finance and other sectors.

Distribution of Shiftworkers

In terms of employees, 206,965 (or 32%) were involved in shiftwork in 1991, compared to 94,015 (or 14%) reported in 1985, or 16.6% using the “most conservative estimate” approach. The increases were significant in both comparisons ($p < 0.001$).

As in 1985, the manufacturing sector had the highest concentration of shiftworkers, accounting for over half the number of shiftworkers (Table III). The electronics industry accounted for 70,098 (or 56.6%) of the 123,740 shiftworkers within the manufacturing sector. In terms of prevalence of shiftwork, most sectors had more than one-third of their workers involved in shiftwork. Compared to 1985, significant increases were noted in the proportions of shiftworkers in all sectors ($p < 0.001$), with the service sector showing the highest relative percent increase.

In absolute terms, the number of shiftworkers has increased for both sexes and for all occupations, as high as 3.5 times in the case of professionals (Fig 1).

In 1991, 64.5% of the shiftworkers were production operators, while 28.4% were clerical workers and 7.1% professionals. Females formed 52.7% of the shiftworkers. Some sex differences were observed in the prevalence of shiftwork by occupation and industry (Table IV). To compare the relative sex differences in prevalence of shiftworkers, the “relative per

Table II – Distributions by Industry of Establishments with 25 or more workers and having shiftworkers (1985 & 1991)

Industry	1985			1991			% Difference (95% CI) ^c	Relative % difference ^d
	All Establishments ^a	Establishments with Shiftworkers		All Establishments	Establishments with Shiftworkers			
		No. (%) ^b	Industry Prevalence		No. (%)	Industry Prevalence		
Manufacturing	1,153	396 (37.7%)	34.3%	1,851	793 (46.2%)	42.8%	8.5 (5.0 to 12.0)	24.8
Commerce	854	315 (30.0%)	36.9%	1,142	435 (25.3%)	38.1%	1.2 (-3.1 to 5.5)	3.3
Transport	240	73 (6.9%)	30.4%	390	113 (6.6%)	29.0%	-1.4 (-3.8 to 5.9)	-4.6
Finance	556	123 (11.7%)	22.1%	718	202 (11.8%)	28.1%	6.0 (1.3 to 10.8)	27.1
Service	247	132 (12.6%)	53.4%	308	159 (9.3%)	51.6%	-1.8 (-10.2 to 6.5)	-3.4
Others	611	12 (1.1%)	2.0%	587	15 (0.9%)	2.6%	0.6 (-1.1 to 2.3)	30.0
Total	3,661	1,051 (100%)	28.7%	4,996	1,717 (100%)	34.4%	5.7 (3.7 to 7.6)	19.9

a: Figures refer to the number of establishments estimated to have been covered in the 1985 study under the category of establishments with 25 or more workers.

b: Figures refer to all establishments reported to have shiftworkers in the 1985 study, here assumed to come only from establishments with 25 or more workers.

c: The % difference is significant ($p < 0.05$) when the limits of the 95% confidence interval (CI) are both negative or both positive. When the lower and upper limits are negative and positive respectively, the % difference is not significant ($p > 0.05$). For example, the % difference for the manufacturing industry is significant while that for the commerce sector is not significant.

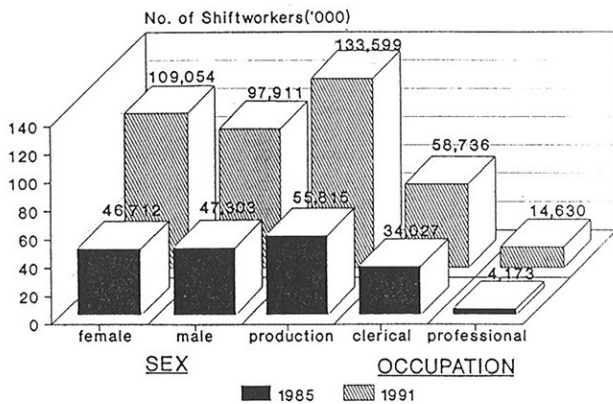
d: Relative % difference is the 1991 industry prevalence expressed as a % deviation from the 1985 industry prevalence. For example, the relative % difference for the manufacturing industry is $[(42.8 - 34.3)/34.3] \times 100 = 24.8\%$

Table III – Distributions by Industry of Shiftworkers from Establishments with 25 or more workers (1985 & 1991)

Industry	1985			1991			% Difference (95% CI ^c)	Relative % difference
	All Workers	Shiftworkers		All Workers	Shiftworkers			
		No. (%) ^b	Industry Prevalence		No. (%)	Industry Prevalence		
Manufacturing	213,422	46,830 (49.8%)	21.9%	323,805	123,740 (59.7%)	38.2%	16.3 (16.0 to 16.5)	74.4
Commerce	101,082	26,232 (27.9%)	26.0%	96,871	39,110 (18.9%)	40.4%	14.4 (14.0 to 14.8)	55.4
Transport	53,218	12,024 (12.8%)	22.6%	62,623	20,563 (9.9%)	32.8%	10.2 (9.7 to 10.8)	45.1
Finance	64,030	2,742 (2.9%)	4.3%	78,563	7,049 (3.4%)	9.0%	4.7 (4.4 to 4.9)	109.3
Service	64,069	5,456 (5.8%)	8.5%	40,537	15,566 (7.5%)	38.4%	29.9 (29.4 to 30.4)	351.8
Others	70,284	731 (0.8%)	1.0%	43,468	937 (0.5%)	2.2%	1.2 (1.0 to 1.3)	120.0
Total	566,105	94,015 (100%)	16.6%	645,867	206,965 (100%)	32.0%	15.4 (15.3 to 15.6)	92.8

- a: Figures refer to the number of establishments estimated to have been covered in the 1985 study under the category of establishments with 25 or more workers.
- b: Figures refer to all shiftworkers reported in the 1985 study, here assumed to come only from establishments with 25 or more workers.
- c: See footnote (c) in Table II.
- d: Relative % difference is the 1991 industry prevalence expressed as a % deviation from the 1985 industry prevalence. For example, the relative % difference for the manufacturing industry is $[(38.2 - 21.9)/21.9] \times 100 = 74.4\%$

Fig 1 – Distributions by Sex and Occupation of Shiftworkers from Establishments with 25 or more workers (1985 & 1991)



cent difference” for each occupational group or industry was computed using the respective male shiftwork prevalence as base 100%. An interesting observation was the relatively higher shiftwork prevalence among females in production and professional jobs and in the manufacturing and commerce sectors.

Types of Shiftwork

83.3% of the shiftworkers worked on 8-hour shift, with 61.1% of these working on rotating schedules. In contrast, among the 12-hour shiftworkers, which comprised 11.7% of the shiftworkers, the permanent arrangement was more popular. Thus 65% of 12-hour shiftworkers worked permanent shifts.

Compared to 1985, the number of shiftworkers has increased for all shift patterns, as high as 10.4 times for 12-hour shiftwork (Fig 2). There also appears to be a trend towards permanent shift arrangements among the 8-hour shiftworkers, with a three-fold increase as against an increase of only 1.6 times in the rotating group.

Nightwork

Over one-third (or 76,294) of the shiftworkers worked beyond midnight. In absolute terms, there has been an increase in the number of night workers of 1.8 times compared to 42,425 nightworkers in 1985 ($p < 0.001$).

Interestingly, however, the proportion of shiftworkers doing

Fig 2 – Distribution by Main Types of Shift Patterns of Shiftworkers from Establishments with 25 or more workers (1985 & 1991)

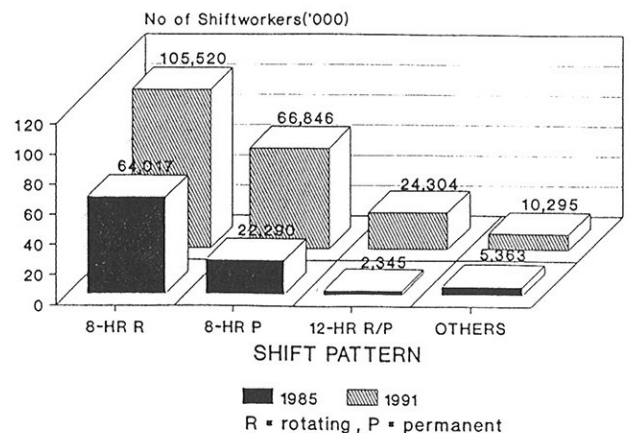


Table IV – Prevalence of Shiftwork by Sex, Occupation and Industry (1991)

Occupation/ Industry	All Workers		Proportion of Shiftworkers (%)		% Difference (95% CI) ^a	Relative % Difference ^b
	Male	Female	Male	Female		
Production	179,299	141,912	33.0	52.4	19.4 (19.0 to 19.7)	58.8
Clerical	74,502	113,486	41.0	24.8	-16.1 (-16.6 to -15.7)	-39.5
Professional	89,227	47,441	9.1	13.7	4.5 (4.2 to 4.9)	50.5
Manufacturing	152,785	171,020	32.0	43.7	11.7 (11.4 to 12.1)	36.6
Commerce	52,531	44,340	35.3	46.4	11.2 (10.5 to 11.8)	31.4
Transport	44,800	17,823	39.5	16.2	-23.3 (-24.0 to -22.6)	-59.0
Finance	36,904	41,659	15.6	3.1	-12.6 (-13.0 to -12.2)	-80.1
Service	16,210	24,327	37.6	38.9	1.4 (0.4 to 2.3)	3.5
Others	39,798	3,670	2.3	0.5	-1.8 (-2.1 to -1.6)	-78.3
All workers	343,028	302,839	28.5	36.0	7.5 (7.3 to 7.7)	26.3

a: See footnote (c) in Table II.

b: Relative % difference is the prevalence of female shiftworkers expressed as a % deviation from the prevalence of male shiftworkers. For example, the relative % difference for production workers is $[(52.4 - 33.0)/33.0] \times 100 = 58.8\%$

Significant sex differences were noted in all occupations and industries – $p < 0.001$ for all comparisons except prevalence of shiftwork in the service sector ($0.01 > p > 0.001$)

nightwork dropped from 45.1% in 1985 to 36.9% in 1991 ($p < 0.001$). It appears that, while there is more shiftwork, the increase in nightwork has not been of the same magnitude.

There was a relatively higher nightwork prevalence among males (Table V). However, exceptions were noted in the professional and production jobs, as well as in the service sector where 22% of female workers worked night shifts.

Table V – Prevalence of Nightwork by Sex, Occupation and Industry (1991)

Occupation/ Industry	All Workers		Proportion of Nightworkers (%)		% Difference (95% CI) ^a	Relative % Difference ^b
	Male	Female	Male	Female		
Production	179,299	141,912	15.6	15.9	0.3 (0.06 to 0.6)	1.9
Clerical	74,502	113,486	14.9	5.8	-9.1 (-9.4 to -8.8)	-61.1
Professional	89,227	47,441	4.3	8.9	4.6 (4.3 to 4.9)	107.0
Manufacturing	152,785	171,020	16.9	13.3	-3.7 (-3.9 to -3.4)	-21.3
Commerce	52,531	44,340	11.5	10.0	-1.5 (-1.9 to -1.1)	-13.0
Transport	44,800	17,823	11.4	3.2	-8.2 (-8.6 to -7.8)	-71.9
Finance	36,904	41,659	8.8	0.9	-7.9 (-8.2 to -7.6%)	-89.8
Service	16,210	24,327	13.6	22.0	8.4 (7.6 to 9.1)	61.8
Others	39,798	3,670	1.2	0	-1.2 (-1.3 to -1.1)	-100.0
All workers	343,028	302,839	12.5	11.0	-1.5 (-1.6 to -1.3)	-12.0

a: See footnote (c) in Table II.

b: Relative % difference is the prevalence of female nightworkers expressed as a % deviation from the prevalence of male nightworkers. For example, the relative % difference for production workers is $[(15.9 - 15.6)/15.6] \times 100 = 1.9\%$

Significant sex differences were noted in all occupations and industries – $p < 0.001$ for all comparisons except prevalence of nightwork among production workers ($0.01 > p > 0.001$)

DISCUSSION

We have documented the current extent of shiftwork in Singapore based on data obtained in our 1991 survey of private sector establishments with 25 or more employees and have compared the data with information obtained in 1985. The findings in the 1985 and 1991 surveys may not be directly comparable because of differences in the size of establishments covered. It is logical to assume that shiftwork prevalence increases with the size of the establishments. This has in fact been observed elsewhere^(4,5). To compensate for this discrepancy, we used the “most conservative estimate” approach, ie we assumed that none of the establishments with 10 to 24 employees in the 1985 survey were involved in shiftwork. With this approach, it is plausible that the differences in shiftwork prevalence observed in the two periods may have indeed been under-estimated. However, we feel that this under-estimation would not be considerable since firms with 10 to 24 employees are less likely to have shiftworkers than larger establishments.

The survey findings indicate a definite trend towards increasing shiftwork in Singapore, involving all industries and occupations. Two hundred and six thousand, nine hundred and sixty-five persons (or 32% of employees in private sector establishments with 25 or more employees) were engaged in shiftwork in 1991. This number would form over 19.5% of the 1,061,181 employees in all private sector establishments.

The current prevalence of shiftwork appears to be comparable with that in Japan. In 1989, 36.7% of Japanese employees from enterprises with 30 or more employees were engaged in shiftwork⁽⁴⁾. It is interesting that the prevalence of shiftwork in Japan seems to have stabilised or decreased somewhat since 1979 - from 17.4% to 15.5% for establishments and from 41.3% to 36.7% for employees⁽⁵⁾. The increase in shiftwork in Singapore between 1985 and 1991 has been considerable, in tandem with the steady economic recovery since the recession experienced in 1985-86, and spurred by the continued growth of capital-intensive industries. It is not certain if, in the long term, the trend in shiftwork will be similar to that in Japan.

We determined the relative differences in shiftwork prevalence and were able to demonstrate some interesting trends which may not have been so apparent from looking at absolute differences. For example, while the absolute increases in prevalence of shiftworkers in the finance and other sectors were only 4.7% and 1.2% respectively, the corresponding relative differences were 109% and 120% (Table III). Similarly, the relative sex difference in proportion of shiftworkers among professionals was 50.5% although the absolute difference was 4.6% (Table IV).

It is noteworthy that females formed over half of our shiftworkers. Many countries, including Canada, the UK and New Zealand, have, in recent years, repealed legislation restricting the employment of females in nightwork in industry^(6,7). In other countries, such as France and Japan, the scope of exceptions to the prohibition of nightwork has been widened. In Singapore, nightwork is prohibited in connection with maternity. However, nightwork is permitted if the pregnant worker consents in writing and is not certified unfit⁽⁸⁾.

It is generally accepted that about 20% of those who start shiftwork may find it difficult to continue in such work, usually for social rather than medical reasons⁽⁹⁾. For those who continue on shiftwork, no long-term health effects have been convincingly demonstrated.

Many studies have shown that shiftwork has adverse effects on health. However, such studies largely utilised subjective assessments of health⁽⁹⁾. On the other hand, when using the

single-blind approach, Dirken⁽¹⁰⁾ found no excess gastrointestinal or nervous disorders in shiftworkers compared to non-shift workers. Similarly, our own studies on both 8-hour and 12-hour shiftworkers^(11,12) have also indicated no serious long-term health effects among these workers, although increased complaints of sleep problems and tiredness were noted, particularly among shiftworkers on some rotating shift schedules. Further studies may be required to determine if measures could be taken to minimise these complaints.

Meanwhile, the tendency towards having permanent shift arrangements and the reduction in the proportion of shiftworkers doing nightwork observed in the present study are encouraging trends.

There is also a need for organisations to establish clear policies on shiftwork arrangements, based on a systematic evaluation of the full economic and health implications of such work schedules in their own context⁽¹³⁾. Employee participation in the planning and implementation of shift schedules is important. Management may find it worthwhile to experiment with innovative shift systems that accommodate their employee preferences⁽¹⁴⁾. The above approach, together with measures to improve working conditions and welfare, will no doubt help to protect and promote the health and productivity of our shiftworkers.

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