Abstract

This paper examines the relationship between health, the technical and social processes of production, and the conditions for reproduction of labor power. The labor process, the family, and the state are seen as key mediating factors in affecting health outcome. The findings suggest that the technical means of production are somewhat more important than the social organization of work in determining health outcomes, and that the process of reproduction is largely shaped by the dictates of life on the production line. The findings also suggest that the women of the workplace are changing as are the concerns of these workers, in their new identity as women industrial workers.

The paper begins with a brief sketch of industry development and a review of the literature on women workers of that industry in Asia. The second section suggests both the general framework and specific aspects of experience that shape the patterns of workers' health and illness. The third section presents the empirical findings of a study conducted in five factories among 900 workers in Singapore and Malaysia. The paper will conclude with an analysis of the political, economic, social, and cultural forces that shape the lives of women workers in the periphery.

Health, Women's Work, and Industrialization: Women Workers in the Semiconductor Industry in Singapore and Malaysia

by

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HEALTH, WOMEN'S WORK, AND INDUSTRIALIZATION: WOMEN WORKERS IN THE SEMICONDUCTOR INDUSTRY IN SINGAPORE AND MALAYSIA

Introduction

Electronics workers in Asia have been the center of much controversy in recent years. Since the late 1960s, large numbers of young women throughout Asian countries have been employed in electronics factories. Journalistic accounts have charged the transnational corporations (TNCs) in the industry with exploitation of young women. These electronics workers are paid low wages and work long hours. It is said that their work environments are hazardous to health and that the companies' management methods capitalize on femininity for labor control.

Most writers of such accounts, along with many labor activists, suggest that TNCs take unfair advantage of these women workers while governments respond only through quiet acquiescence. Defenders of the industry usually argue on the low standard of living in the Asian countries, the countries' need for employment, and the relative cleanliness of the electronics industry. Charges and countercharges over the social justice of women's work in the electronics industry remain largely unresolved.

The debate is, in part, the impetus for the present research. At the empirical level, there is a need to go beyond anecdotes to understand systematically the phenomenon of large numbers of young women entering the formal sector workforce for the first time in Asia's history. Health is of specific interest in this research, not only as a necessary contributing factor to the stability and productivity of the labor force, but also as a reflection of industrial and social conditions.

In taking a political economy of health approach, the point is not simply to demonstrate, as have many radical health critics, that "capitalism is bad for your health"; rather, the study is a search for the structures that mediate between the macro-level dynamics of capital accumulation and the micro-level functions of workers' bodies. It is argued that these mediating structures occur in diverse spheres of life -- the labor process, family, community, and culture. It is through the interaction of these different factors -- their conjuncture being historically specific -- that health and illness are socially produced.

This paper will first survey electronics workers in Asia, through a brief sketch of industry development and a review of the literature on women workers of that industry in Asia. The second section will suggest both the general framework and specific aspects of experience that shape the patterns of the workers' health and illness. The third section will present the empirical findings of a study conducted in five factories among 900 workers in Singapore and Malaysia. The paper will conclude with an analysis of the political, economic, social, and cultural forces that shape the lives of women workers in the periphery.

Development of the Electronics Industry

The electronics industry is a large, diverse industry which is made up of two major sectors: components and final products. The components -- which are combined into final products -- can be further divided into passive (e.g., capacitors, resistors) and active (e.g., semiconductors, tubes) components. The final products can be further divided into consumer, industrial/scientific, and military/aero-space.

The electronics industry has undergone a rapid technological change which is best characterized by the semiconductor industry. Preceded by vacuum tubes since the 1920s, the semiconductor industry fully emerged with the development of the transistor in the 1950s. And with the development of the integrated circuit (IC) and the growing demand for computers in the early 1960s, the semiconductor industry began to mushroom. Other large, captive producers also entered the competition. By the early 1970s there were 96 U.S. companies producing semiconductors. These ranged from diversified corporations like Monsanto, to captive producers like Motorola, to merchant IC houses like National Semiconductor.

Although the types of ICs are numerous, the production processes, all following circuitry design, fall into the same basic flow: (1) mask-making, (2) wafer fabrication, (3) assembly, and (4) testing (Oldham 1977). The mask-making step is basically a photo-reduction process to reduce the size of the circuit design. Wafer fabrication represents the most complex and sensitive of the processes, when slices of silicon crystals are doped with chemical impurities to create electronically conductive and non-conductive areas on each chip, the circuit pattern then being etched into the wafers with acids and solvents. In the assembly stage, the wafers are cut into individual chips, which are then attached to substrates (or headers) and bonded under microscope to the appropriate points on the circuit. Finally, the packaged devices are subjected to a series of temperature, leakage, and electrical tests. The required workforce for the production of semiconductors consists of a large number of talented scientists and engineers and a large number of semi-skilled and unskilled production workers (U.S. Department of Commerce 1979).

Because of rapid technological changes, the products of the semiconductor industry have a very short product cycle (Chang 1971). With constantly expanding volume and improved technology, the prices of these products have also consistently and rapidly fallen after their initial introduction to the market. These reasons, along with the phenomenal growth in the number of manufacturers, cause the industry to be highly competitive in all countries. Continuous research, development, and capital investment in equipment are vital. Hence, the survival of any company essentially depends on the ability to introduce new, superior products early and to keep the variable costs of production -- the majority of which is labor -- very low.

Because the process for production of semiconductors can be segmented easily into the four steps, because the products are small and lightweight,

and because manufacturers need to hold labor costs down, American semiconductor firms, being industry leaders, began to set up an international assembly line in the 1960s, with the Europeans and Japanese following shortly thereafter. The semiconductor industry's search for off-shore locations coincided with the adoption of a rapid industrialization strategy by many Asian countries. It was a time when a development strategy of import-substitution was seen as a failure. When Taiwan's Kaohsiung Free Trade Zone was successfully set up in 1965, other governments also built free trade zones and developed industrialization policies that were export-oriented. To attract foreign investments, Asian governments offered a variety of incentives, such as tax holidays, import duty waivers, unlimited repatriation of profits, and controls of labor-organizing activities. These governments, interested in all types of direct foreign investments, found opportunities in all branches of electronics, garments, textiles, footwear, toys, sporting goods, and other labor-intensive enterprises.

Among the semiconductor manufacturers, Fairchild was the first to begin off-shore sourcing when it set up an assembly plant in Hong Kong in 1962. General Instrument was the first in Taiwan in 1964, and Fairchild the first in Korea in 1966. National Semiconductor established a flood of firms in Singapore in 1968 and Malaysia in 1973, and then set up the first plant in Thailand in 1974. Assembly plants were set up in the Philippines and Indonesia in 1974. Although Asia has been the preferred region for off-shore sourcing, a few plants are also found in the Caribbean area and Mexico. In these less developed countries (LDCs), the semiconductor firms were involved only in the most labor-intensive process (assembly), with other steps in the process being done at the home country; only in recent years have they started to shift testing operations to a few Asian countries. Today, without exception, every established U.S., if not other, semiconductor firm is engaged in some off-shore assembly.

Economic imperatives were important in the move to develop a global assembly line. Studies of industry leaders (Saxenian 1981; Lim 1978a) cite as the most important reason for locating overseas the plentiful supply of low wage labor in LDCs. When the electronics industry was rapidly developing in Asia in the mid-1970s, low wages (see Table 1), especially relative to the level in the U.S., presented a great attraction to the TNCs.

Although wages in all these countries are low, there are substantial differences among them, in part reflecting the chronology of electronics industry locations in Asia. Between 1976 and 1980, wages in electronics had risen considerably in these countries. Still, the wages were substantially less than those in the U.S. or Japan, as seen in Table 2.

Other issues identified by the corporations as important locational factors were: (1) the cost, reliability, and accessibility of transportation and communications, (2) tax holidays and other investment incentives, (3) proximity to local markets, (4) local infrastructure, and (5) political stability (including ability to control labor unrest).

By 1974, approximately 103 off-shore assembly plants were established by U.S. semiconductor companies; all of these operations employed large numbers of women. The size of the electronics industry is impressive, as shown in Table 3.

Compared to both women's proportion in the general population and their employment in the manufacturing sector, the concentration of women in the electronics industry (all branches) is disproportionately high, as seen in Table 4.

The concentration of women in electronics is no mere coincidence, since the presence of a large, low-wage, female labor force is a well-documented reason for corporate locational decisions to invest in Asia. A variety of reasons is given by company management and researchers for the preference for female labor (Grossman 1978; UNIDO 1980; Froebel et al. 1980; Eisold 1982; Elson and Pearson 1981; Lim 1978b). These can be grouped as (1) physical characteristics, (2) social and cultural attitudes and behavior, and (3) position in the labor market.

The most common explanation for concentration of women workers in assembly work is that women have nimble fingers, agile hands, and keen eyesight. They are considered to be more efficient and careful than men. Their dextrous skills are believed to be derived from experience in needlework and other domestic chores; therefore they are considered well suited for labor-intensive jobs that focus on fine detail.

Women are also preferred because they are considered to be more patient, more cooperative, and more easily controlled than men. Indeed, the socialization process for women in traditional and patriarchal societies probably means that women, especially young women, are more respectful of authority, more passive and obedient, and more malleable than men. They are therefore considered well suited to monotonous and repetitive jobs.

In addition, the wages that women earn in less developed countries are even lower than the prevailing wages for men (Lim 1983). Occupational segregation by sex tends to be more rigid in less developed countries. Because of strict sex-role stereotyping and lack of employment opportunities for men, women have few opportunities for paid employment outside the domestic setting. It is generally assumed that men are the primary breadwinners, and women work either as supplemental wage-earners or only until marriage. Women are seen as lacking financial obligations and career aspirations. They are therefore considered well suited to jobs that pay low wages and that have minimum job advancement opportunities.

For these reasons the electronics companies have sought out and hired women workers in Asia. Today, in most Asian countries, the electronics industry accounts for a large proportion of the employment in manufacturing as well as a substantial proportion of the female labor force.

Lives of Asian Electronics Workers: Work and Health

The sociodemographic profile of the workers has been documented in a variety of research reports, both government and private (Maex 1983; Arrigo 1980; Forebel et al. 1980; Snow 1978; Blake and Moonstan 1982; Woon 1982; K.C. Chia 1981; USM 1982). The workers' backgrounds are fairly similar throughout Asia. They can be characterized as: young, unmarried female, usually rural with little education or skills, and from the lower socioeconomic strata. (See Table 5.)

The young age of electronics workers is the first noticeable feature. The overwhelming majority of these workers seem to be in their twenties. While the lower age limit appears to be largely determined by law, the upper age limit appears to be tied to marriage in many places. While the overwhelming majority are unmarried only a small number are new entrants to the labor market. The workers' educational backgrounds, usually between primary and secondary schools, are tied both to their young age and to the hiring requirements of the companies.

The places of origin of the workers vary. Rural-urban migrants and international migrants are both important features of the electronics workforce. Studies suggest many reasons for labor migration in Malaysia: rural poverty, lack of job opportunities in the agricultural sector, search for jobs more suited to education, and fulfillment of occupational aspirations (Jamilah 1980; K.C. Chia 1981). Rural women in Taiwan need to contribute to family welfare while in places like Hong King and Singapore, most families require more than one wage earner to maintain a minimum level or slightly more than comfortable standard of living (Kung 1978; Salaff 1981; UNIDO 1980). The employment of daughters helps pay bills, support families, and create educational opportunities for younger siblings, especially sons. Even when the additional income does not go back to the family, as in Indonesia, a working daughter means a reduced economic burden on the family (Wolfe 1984).

The desire to achieve economic independence as well as individual freedom is another reason for migration in most Asian countries. In Malaysia, workers reported their hopes of achieving freedom and "standing on their own feet" (Jamilah 1981). In Taiwan and Hong Kong, women saw factory work as an opportunity for income, greater independence, and a better future (Kung 1978; Salaff 1981). In the Philippines, workers were attracted to factory work not only by the wages but also by the opportunity to make new friends and to escape the restrictive traditional social life of the villages (Snow 1978).

Whether the income goal is attached to independence or family support, the workers are paid low wages which are below the Asian standard of living (L.L. Lim 1982; Lim 1978b, Lim 1983; Froebel et al. 1980; Grossman 1978). One labor newsletter's poignant characterization of the relationship between wages and living expenses is illustrated in Table 6.

Obviously, basic expenses (rent, food, transportation) vary from country to country, but they take up a considerable portion of the worker's monthly pay in any case, as seen in Table 7.

Work hours can vary by location and business demand. Overtime is prevalent at times of high productivity, but the demand on industry is subject to wide fluctuation; during the 1974 recession, for example, an estimated 15,000 electronics workers in Singapore (about half of the industry) were retrenched (Lim 1978b). More than the hours, workers complain about shiftwork, which increases as automated equipment is introduced. In some countries, such as Singapore and Malaysia, existing legislation against night work for women has been waived to allow electronics companies to introduce rotating shiftwork and permanent night shifts. The workers have complained that rotation is disruptive to eating and sleeping, family responsibilities, and social life.

In addition to the shifts, workers' lives are dominated by production targets to which workers' wages are often tied. Failure to meet a target can mean insufficient daily pay, loss of merit increases, being scolded in front of other workers, or even dismissal. To maintain the push for productivity, management often displays graphs showing production achievement by individual workers and promotes competition between departments or individuals to achieve targets (Lim 1978b).

Because of the hours, the shifts, the fast pace of work, and pressure from management, many researchers have reported repeated complaints of stress and fatigue (Grossman 1978; Lim 1978b; Woon 1982; Paglaban 1978), though few systematic studies have been undertaken. (See Table 8.) Numerous anecdotal reports reveal problems such as eyesight deterioration, respiratory diseases, and even cancer among workers. Even the few descriptive surveys which have been conducted substantiate the prevalence of complaints reported in the more sensational accounts. A few health surveys have looked at overall health problems. Eyesight problems, skin disorders, gastrointestinal problems, and musculoskeletal problems have all been documented, as well as complaints of dizziness, insomnia, and weakness. Mass hysteria has also been frequently reported in the electronics industry in Singapore, Malaysia, and Indonesia, as well as in the U.S. (Ackerman 1980; Chan et al. 1979; Chew et al. 1976; Lim 1978b; Colligan et al. 1979). Some researchers even report that health problems are a major cause of labor turnover (Froebel et al. 1980; Elson and Pearson 1980; Blake and Moonstan 1982). One report suggests that the eyesight of the workers becomes so poor that many have to vacate the workforce by age 25 (Grossman 1978).

Generally, Asian governments have few regulations regarding health and safety. They may have labor laws that guarantee holidays, breaks, sick leaves, and maternity leaves, and they may provide a range of health care services, but occupational health laws are still lacking. Where regulations do exist, they tend to be structure- or process-oriented in that they tend to specify composition and frequency of meetings for safety committees rather than set standards for health and safety. Enforcement is a rarity.

Companies place emphasis on health only at the time of employment. After recruitment interviews, workers are usually required to take an eye test, x-rays, medical examination, and a pregnancy test, for management and placement purposes rather than for the workers' health. In general, newly hired workers test at above average physical and mental health. Once on the job, though, it is up to the worker to have regular check-ups, although a few TNCs are now beginning to set up biological monitoring systems.

Outside of work, the literature also portrays a workforce of young, helpless women who are ruthlessly exploited, in the pejorative (rather than economic) sense, by TNCs. Table 9 summarizes the literature on the conditions for the reproduction of labor power.

For migrant workers, at least in Malaysia and Indonesia, men pose an additional stress factor in their lives outside the factory (Blake 1975; Grossman 1978; L.L. Lim 1982; Jamilah 1980; Mather 1982). Back in the villages, traditional family life both protected and controlled this factor. Courtship and marriage, if not actually decided by the family, always involved family advice and consent. But after migration, a worker is cut off from these interactions. Many young women do not know how to cope with being accosted by strange men. The typical image of the modern city also creates an impression for villagers that factory workers are immoral, or "loose." Village men often refuse to marry women who have worked in factories. In their new communities, the women are also seen as outsiders. In Thailand and the Philippines, factory workers sometimes drift into the large and well-established prostitution industry either when they are retrenched or when they need additional income, thus further tarnishing the image of women factory workers (Eisold 1982).

While most of the research to date has portrayed electronics workers as oppressed victims, there are some reports that look at the experience from the workers' subjective viewpoint and consider their adaptive processes (Jamilah 1981). It does appear that, in the 10 to 15 years of being part of the industrial workforce, these women workers' outlook and aspirations have changed; they have developed their own ways of adapting and coping.

Increasingly, young women with limited skills see jobs in electronics factories as a means of gaining economic and social independence as well as finding new friends who come from different places and varied backgrounds. The job experience has given many workers the hope of better job opportunities. While some are pursuing further vocational studies, others plan to move into government service, allied health professions, or shop ownership (Fatimah 1983). Increasingly, women are making their own choices of marital partners rather than following family preferences. Migrants are indicating a preference for settling in urban areas. Also, families are beginning to accept the independent decision of working daughters, be it marriage or job choice. Their voices are more respected in family financial decision-making and their advice is sought on the futures of their siblings (Kung 1978).

To women, these jobs have brought some benefits; yet, to the observed, their work has not brought about structural change. Despite these changes on the individual and family level, the overall social role prescribed for women is slower to change. Women are still confined to the role of housework and to the secondary labor market (Chiang 1982; Lim 1982). In some ways, the burden and conflict experienced may be greater than before.

Clearly, the development of the massive electronics industry in Asia has set various social forces into motion: women entering the manufacturing workforce in large numbers; rural women migrating, sometimes on their own, to cities; the changing patterns of friendships and marriage choices. Also, within the factories women have to learn a new set of rules of behavior -- that of factory discipline -- and they are working under conditions they have not experienced before. All of these changes have important consequences for workers' health. The health of electronics workers is important as a central contributing factor in the stability and productivity of the labor force and as a reflection of the social and industrial conditions of life.

Given these conditions, a number of health problems would be expected. Some of these have been reported in anecdotal accounts and descriptive studies, such as complaints regarding the eye, musculoskeletal, skin, respiratory, gastrointestinal, and central nervous systems, sleeping problems, and psychological complaints. Others are expected on the basis of the existing literature in occupational health and social epidemiology.

A variety of causes has been suggested for these health problems. The deleterious effect of microscope use is the most frequent and most hotly debated hazard (Lim et al. 1972; Ostberg 1984). A variety of potentially hazardous chemicals is also used in various stages of electronics assembly process, including TCE, MEK, xylene, acetone, solder flux, sulphuric acid, and hydrochloric acid; they are suspect as causes for skin and respiratory diseases (California DIR 1981; Burge et al. 1979; US NIOSH 1977). Shiftwork has been suggested as the cause of sleeping problems and gastrointestinal disturbances (Tasto et al 1978; Angersbach et al. 1980). None of these causes has been thoroughly analyzed, nor have the health complaints been related to other possible causative factors, such as stress, nutrition, social support, migration, lifestyles, and various aspects of the work environment. Nor have any of the health (physical and mental) controversies been settled.

The lives of electronics workers in Asia incorporate the diverse issues of concern in the occupational health and social epidemiology literature. It is highly likely that the health and illness of electronics workers relate to the technical means of production, the social organization of work, and consumption and reproduction patterns. There are obvious health outcomes related directly to the technical means of production, such as microscope and eyesight determination; there are also problems related to the organization of work, such as shiftwork and sleeplessness. A state of ill-health persists when the occupational assault is great and the

replenishments inadequate. Through food intake, rest and recreation, and a variety of services, the state of health can be maintained at a balance. This pattern of consumption, however, varies according to income, household structure, service availability, and many other factors.

Workers may also adopt other individual coping behavior that would be damaging to their health, such as alcohol or drugs. These coping methods may also be carried into the home and community, in the form of behavior such as child abuse or other "socially deviant" responses. It is evident that the work experience is transforming a world view which embodies not only the social relations in the workplace but also the workers' position in the labor market. In turn, the dynamics of that labor market are dependent upon the actions of the state, the ideology of women's work, and the historical period of capitalist development. Three phenomena are being examined regarding electronics workers in Asia, the electronics industry being the example par excellence of the new international division of labor. (1) The entrance of women into factory work is historically unprecedented in those countries. (2) The export-oriented industrialization strategy of Asian countries has been considered both the path to successful economic development and to the most ruthless means of exploitation. (3) The conditions of the electronics workers illustrate both the impact of export-oriented industrialization and the new international division of labor on women workers as well as the conditions under which a new industrial worker class labors in early capitalist development.

Capitalist Development, Women's Work, and Health

The development of the new international division of labor has set a historic precedent. While women have always worked (Boserup 1970), it is with the incorporation of peripheral societies into the current world capitalist system that women have entered into wage labor, especially in the manufacturing workforce, in large numbers. This process influences a fundamental social and economic transformation of society which is vital to the continued development of capitalism in LDCs.

Existing documentation on the lives of women workers in LDCs, which points to the conditions of low wages, long hours, and hazardous environments, suggests that these women are exploited by the TNCs who hire them, and that inevitably women are losers in economic development. These statements can be simplistic wherever historical circumstances, the internal national dynamics, and the general patterns of work and consumption in LDCs are ignored. Yet, these statements are correct insofar as TNCs represent the quintessential penetration of capitalist relations into LDCs; women's work during early capitalist development in Europe, the U.S., and Australia can similarly be characterized. In effect, under the new international division of labor, the working class is emerging in LDCs, where women workers are central to the proletarianization process.

Indeed, there is a remarkably similar history of changes in women's role in society between 19th century Europe and 20th century Asia. In Europe

then and in Asia now, as women were "free" labor, unattached to other trades, they were identified as a trainable, docile, and cheap labor force for early industrialization, in both the textile mills and the electronics industry. During this time, the tendency, as exemplified by the textile and electronics industries, was/is to bring more and more women into the factory labor force, to require longer hours of work per day, and to increase both the length of the work week and the level of labor discipline and intensity. Between the rapidly changing technology and the ever-increasing manufacturing competition, the textile and electronics industries experienced crises of over-production and excess capacity; the resulting instabilty of the industry was mirrored in the lives of the women workers.

Evidence from America shows that all textile corporations of this period adopted a unified set of policies from the outset (Dublin 1979). They shared technological developments, labor policies, and marketing strategies. Mill architecture, the organization and technology of production, and the regulations adopted for workers were virtually identical. They made repeated efforts to ensure that the various establishments did not compete with one another in wages or working conditions. In Asia the electronics industry operates in a similar manner today.

Previous to the factory system in England and France, women performed productive household services. With the introduction of the factory system, and the development of the textiles industry in particular, women's employment outside the home, as wage labor, increased sharply (Tilly and Scott 1978); the same phenomenon is occurring in Asia. In both 19th century Europe and 20th century Asia, the concentration of industrial jobs in certain cities and regions drew young rural women away from their homes. Women's work moved away from being defined by household labor needs to being defined by the household's need for money. Daughters dominated the labor force in mill towns, or free trade zone areas, and made important, and expected, contributions to the family fund.

In both Europe then and Asia now, young girls who were sent away -- as migrants to the cities -- were in the most vulnerable positions, for they were outside the context of family and community. While expecting to accumulate the requisite resources for marriage and family, some found their wages barely sufficient for their own support. Employers justified their low wages on the basis that women were only supplemental wage earners for the family.

The phenomenon of women working in factories was socially controversial in 19th century Europe (Engels 1973; Berch 1976). While some commentators welcomed jobs for women, others were alarmed at the sight of women operating machines and disturbed about the social consequences of women working away from home. Eventually there were waves of concern over the deterioration of health and morals of women, of their ability and desire to bear children, and of the stability of the family as a social institution. In Asia today, such concerns are regularly expressed.

In the course of industrial work, however, women did develop new attitudes. Historical research suggests that a close-knit community among

women workers developed at the workplace and in the boarding houses (Dublin 1979; Tilly and Scott 1978). Evidence of the same trends is emerging from Asia.

The history of women's work in the early phase of capitalist development is being repeated in LDCs today, although in the nature of today's capitalist system, the political and cultural contexts are different. Certainly, the conditions of electronics workers in Asia, as evidenced in the literature, echo the experiences of women workers in 19th century Europe and America. At least at the descriptive level, a similar sociodemographic profile of the workforce, similar management practices, similar household expectations, and similar labor responses can be identified.

The similarities between conditions facing today's women workers in LDCs and those facing women workers in 19th century Europe and America are not surprising. In both instances, the proletarianization of women is integral to industrial development and capital accumulation. For many, especially those in company management, women are seen to have patience for tedious jobs, with their nimble fingers and visual acuity (Lim 1978; Elson and Pearson 1980). They also see that work as a temporary phenomenon for women and that women cannot work in physically demanding jobs. Therefore, women constitute a natural, low-wage labor force. Women are seen as most suited to labor-intensive industries. The better explanation for concentrated female employment, however, lies in the higher profits that can be extracted from workers who earn lower wages (Lim 1983). The subordination of women as a gender reflects both the ideology of patriarchy and women's secondary position in the labor market (Elson and Pearson 1980). The lack of effective bargaining strength has reinforced discriminatory practices.

Women have been called into and out of the labor force as needed by national ideology and economy (Mackintosh 1981). The position of women in the labor force fluctuates in consonance with the requirements of capital accumulation and expansion. Fernandez-Kelly (1983) suggests that women's labor is preferred in (1) periods of early industrialization, (2) times of crisis (when male labor supply diminishes), (3) situations of fierce competition (and hence, need to reduce operating cost to a minimum), and (4) circumstances where the reduction of costs entailing the reproduction of labor power is attached to women's work (Fernandez-Kelly 1983). Women workers occupy low-paying, low skill, low mobility jobs, but also constitute a high-turnover labor force.

Women's position as a low-wage force in the secondary labor market means they are highly desirable employees in labor-intensive industries, which constantly search for cheap labor (Safa 1981). In 19th century Europe and America, the initial approach was to recruit women from rural areas; then, immigrant labor provided a fresh supply of women whose need for income meant they were willing to work longer hours for lower wages. Female workers become further divided by citizenship and place of origin (Thomas 1982). With limited alternatives, both migrants and women readily accept their state of being (Piore 1979).

Eventually, the industries moved to areas, such as to most LDCs today, with vast labor reserves caused by high unemployment, high population growth, and the weak, underdeveloped national economies. In LDCs, the weak development of productive forces results in national wage differentials between them and advanced capitalist countries. These differentials attract labor-intensive industries which must employ low-wage labor (i.e., women) to remain competitive (Lim 1984); with industrialization, female employment ghettos are created by foreign manufacturing investments.

The electronics industry is the example par excellence of the new international division of labor. Its important contributory role to the Asian "economic miracles" illustrates both the process through which LDCs are incorporated into capitalist accumulation and the process through which capitalist development in LDCs occurs domestically. A study of the health of the electronics workers in Asia adds more than an empirical understanding to the articulation of the diseases of both underdevelopment and development: it also suggests the way the newest stage of world capitalism shapes people's health. Insofar as health is a reflection of a society's re-creative potential, the barometer of health encompasses, in microcosm, the totality of the capacity to produce use values to meet people's needs and wants.

The point is not to say, as many radical critics have said, that "capitalism is bad for your health." Rather, the study of health requires a search for the structures that mediate between the macro-level dynamics of capital accumulation and the micro-level functions of workers' bodies. These mediating structures lie in diverse spheres of life -- labor process, family, community, and cultures. It is through the interaction of these diverse factors -- and their conjuncture being historically specific -- that health and illness are socially produced. (See Figure 1 for a general illustration of the framework.)

Such a model formalizes the general approach to the political economy of health. The various illustrated relationships are interactive and dynamic, although the specific social forms will differ according to the historical period.

Insofar as the health of the working class is a reflection of the social totality, the study of its health points to the articulation of the social and economic institutions surrounding the workers. The limits placed on women workers by their social role and economic position, through state policies and cultural institutions, have far-reaching consequences on their well-being. The conditions of the women workers also illustrate the process through which capitalist development is occurring in LDCs today, under the new international division of labor. The pattern of health and illness reflects not only the costs of benefits to workers of the particular path of development, but also the manner in which labor power is consumed and reproduced under those particular paths.

The workers' health, shaped by the labor process, reflects the technical and social organizations of work and embodies the social, political,

economic, and cultural institutions of society. Three key institutions -- the labor process, the family, and the state -- mediate between the international system and women's lives (and health) of electronics workers in Asia.

Although hierarchical organization of production is not peculiar to capitalism (as craft production was also hierarchically differentiated), it is under capitalism that hierarchical authority comes to dominate the workplace by expropriating control of the means of production from workers (Marglin 1982). With the spread of factory production, the power of employers over their increasingly wage-labor was consolidated. Furthermore, fragmenting the labor task via mechanization created the opportunity to achieve much higher levels of labor discipline -- and labor intensity. With the concentration of activities in the factory, productive tasks could be synchronized in a complex division of labor. A labor discipline embodied within the detailed division of labor is reinforced by the segmentation of labor markets. The fragmentation of the labor market by gender and class, beyond demarcation by technology and workers' skills, is also fundamental in sustaining social control, where the labor force becomes divided against itself.

Unlike other commodities, however, labor cannot be bought in a precise manner, for labor involves thinking beings who have the ability to decide, individually or collectively, how much effort they are willing to commit and under what conditions. Thus, the production technology and the social organization of production are important means through which employers can constrain the discretionary power of workers. Machines can pace the workers' efforts, and an additional system of incentives and sanctions can channel and encourage those efforts. Management exercises its judgment on staffing levels, speed of line, length of rest breaks, allocation of tasks, movement of workers across tasks, levels of exposure to hazards, and conditions for hiring, firing, and promotion. Workers, on the other hand, may be involved in the continuous challenge of management perogatives.

Workers also bring a variety of expectations and have unique relationships to their jobs, and they are further transformed by their work experiences. Comparison of women and men in labor-intensive jobs suggest that women's ability to tolerate monotony, discipline, and repetitive work may be related to their socialization as women (Balzar 1976), although gender segregation of jobs may socialize women into different aspirations (Kanter 1982). Because women tend to be in low-mobility situations, they tend to limit their own aspirations, seek satisfaction in activities outside work, and create sociable peer groups in which interpersonal relationships take precedence over the aspects of work. Although wages may have been the impetus for them to seek industrial work in the first place, job satisfaction arises not so much from wages as from their newly formed friendships and raised self-esteem and confidence. Participation in industrial work can change not only the workers' economic standing but also their ideologies (Saffioti 1983).

The existence of the family as the central economic unit within the family wage economy is not only historically important but also central to the reproduction of the labor force. The reproductive functions provided by the household -- usually by the extended family in LDCs -- are reflective of the level of publicly-provided social infrastructure. Where the infrastructures necessary to allow exploitation of resources have not been made available by government or the private sector, it becomes the household's responsibility to provide a level of consumption necessary to reproduce the labor power.

In places such as Singapore and Malaysia, while the pre-capitalist social formation is being destroyed at the same time as the middle class and wage labor are expanding, petty commodity production still survives rather extensively (M.H. Lim 1982). It is the household and the informal sector that absorb the shock of capitalist development (Wong 1981).

For electronics workers in Asia, outside employment is a matter of household income strategy, whether realized in remittances or decreased economic dependence. Since having an income is often the greatest priority, there may not be a choice of working, not working, or working at a particular job. At the same time, women are expected to carry on with their household functions -- cooking, cleaning, childcare, and other domestic chores. In effect, women work a double day.

The state is an equally important institution in shaping women's position, through its interaction in social economic policy. The nature of the education system determines the position of working class children in the labor market. The language of instruction is particularly important in such multi-racial and multi-lingual societies as Singapore and Malaysia. The extent to which housing, medical care, and transportation services are publicly provided will determine the extent of private investment in reproductive activities. Availability of social security and unemployment benefits are clearly important in terms of the pressure on workers to accept, or remain in, unattractive jobs.

The state also plays a central role in facilitating foreign investments, therefore developing capitalist relations. Its role in providing investment incentives includes not only tax holidays and infrastructural supports but also maintenance of the minimum level of consumption necessary for the reproduction of the labor force and the control of labor unrest. Insofar as state policies reflect conditions of class struggles, however, the policies of national government vary. In Singapore, for instance, the state, under the rubrics of national economic planning, has supplanted the older forms of family patriarchy, by intervening extensively in almost every sphere of social and economic life. In most other countries, the state provides the conditions necessary for, rather than directs, the penetration of capitalist relations in every facet of life.

Nearly all aspects of economic policies can have effects that are felt by workers. The degree to which the economic base is diverse and expanding

shapes the job opportunities available. The extent to which industries are regulated in terms of working conditions will clearly impact worker well-being. The degree to which labor organizations are controlled will indicate how varied the channels are to express job discontent. In these and other ways, the state shapes the labor process as well as ideology and reproduction.

The state also plays an important mediating role in providing the conditions necessary for capital accumulation, for production of labor power, and for reproduction of labor. The policies, incentives, and regulations are reflected on the shop floor, in the daily experiences of workers, as well as in their lives outside the factory. Yet, capital accumulation also alters class formation and conversion, income distribution, and social relations (including labor market relations). The state must continually mediate between the global rationalities of TNCs, the necessities of local accumulation, and demands by labor. The state, then, is both an agent of accumulation as well as an agent of social control. Its role is to foster development, however dependent.

That women work in labor-intensive factories in LDCs today is evident in the resulting complex social, economic, and political forces. Under the new international division of labor, a new working class is emerging, with women at its center.

In taking a political economy of health approach, it is understood that health conditions reflect the interaction between biological and social systems and are a microcosm of the social totality. With such an approach to the study of electronics workers in Asia, the aim is to arrive at a better understanding of how the dynamics of the larger system affect people's well-being, both individually and collectively. The changes in the labor process and in those institutions reflect developments in the world capitalist system. Under the new international division of labor, the most recent tendency in the capitalist system, Asian countries are becoming capitalist countries in their own right.

The Empirical Study

Methodology

The study seeks to understand the relationship between worker's health and (1) the technical means of production, (2) the social organization of work, and (3) the patterns of consumption and reproduction. The study is centered around a survey of 900 semiconductor workers in Singapore and Malaysia and a 10% subsample interview. The survey questionnaire method was chosen both because collected statistics on the health of electronics workers as a group did not exist, and because of the need to go beyond the anecdotal information previously reported in the literature.

To obtain large random samples of workers, access to the workforce was obtained through management cooperation at five semiconductor companies

which produced similar products, so the technical aspect of the work process was similar.

While the production workers constituted the study group, clerical workers from the same firms were used as the comparison group. The clerical workers were chosen as they often come from socioeconomic backgrounds similar to production workers. Working in the same firms meant they were subjected to similar corporate cultures and policies, although they were involved in different production processes. While clerical workers earned slightly more money, the extra would likely be spent on work clothes.

The survey questionnaire was closed, structured, and trilingual in English, Chinese, and Malay. It was designed to be either self-administered or completed through an interview. The questions covered sociodemographic variables, work history, income, housing and transportation, recreation, diet, work hours, work environment, job design, health and safety practices, accidental injuries, absenteeism, recreation, health care utilization and preferences, illness experiences, symptomatic complaints, reproductive outcomes, and job satisfaction. These variables would reveal the technical means of production, the social organization of work, and the consumption patterns of the workers, as well as health outcomes. The sampling of workers was stratified by production department.

From the survey returns, a 10% sample was drawn randomly, stratified by job category, for in-depth interviews. These interviews served both as a validity check on the surveys and as a mechanism to gain deeper insights, particularly into workers' feelings and thoughts. These interviews were open-ended and covered such issues as personal and family backgrounds, motivation for work, job history, housing and social life, income and expenses, job tasks, health and safety, job design, company services and benefits, health care preferences, hopes and aspirations. The interviews were conducted in English, Chinese (Mandarin), and Malay.

To supplement the survey and interviews, company records that were routinely kept and made available were reviewed. In addition, interviews were conducted with company management, nurses, physicians, and safety officers on relevant personnel and production policies and on health and safety concerns.

In Singapore, two leading semiconductor firms granted access to over 450 production workers and about 100 clerical workers. In Malaysia, three other semiconductor companies granted access to about 380 production workers and 70 clerical workers. With an average return rate of 90%, there were a total of 903 surveys available for analysis (518 from Singapore and 385 from Malaysia.[1] Among the 101 interviewees, 54 were from Singapore and 47 were from Malaysia.

The survey data were stored in a Kaypro 10 microcomputer; the software used was DBaseII (software package for data base management) and Abstat (software package for data analysis). All other data were manually coded

and analyzed. Data from companies in the same country were pooled in the analyses.

The Countries

Formed in 1963, the Federation of Malaysia is made up of 11 states on the peninsular mainland and the territories of Sabah and Sarawak in north Borneo. The total population today is 13.8 million, with 54.7% Bumiputra,[2] 34.2% Chinese, and 9% Indian. The island of Singapore, located at the tip of the Malayan Peninsula, joined the Federation in 1963 and became an independent city-state in 1965. Its population today is 2.4 million, with 76% Chinese, 15% Malay, and 7% Indian. The history of the two countries is closely intertwined, although their paths have diverged somewhat since 1965. Because of their geographical positions, two important themes throughout their history are trade and migration.

Beginning in the 16th century, with the seizure of Melaka by the Portuguese in 1511, the Malayan Peninsula began to be incorporated into the European colonialist and nascent world capitalist system. Despite these military conquests, the local social and economic structures were relatively untouched, compared to colonial rule elsewhere. Despite trade and other associations with foreign powers, however, the vast majority of the indigenous peoples was involved in subsistence farming, and gathering of jungle products.

Under British rule, Malaya in the 1800s experienced increased migration and increased exploitation of natural resources. British rule in Malaya was significant for establishing class and spatial segregation along ethnic lines through strict segmentation of the labor force and the education system. It was also significant for establishing the framework of dependent export economy. Capitalist methods and relations of production were introduced in the export sectors, while pre-capitalist relations of production, particularly petty commodity production, were preserved in the subsistence sector (H.M. Lim 1982). New classes of urban and rural proletariats and comprador bourgeoisie were created, with members of these classes coming from different ethnic groups. Malaya was being transformed from a relatively self-sufficient society into a market economy dependent on price fluctuations in the world market. Although an industrial infrastructure was built, it served the purpose of extracting surplus from the colony.

By the time of formal independence in 1965, the Singaporean government found itself in a situation of a rapidly rising unemployment rate and internal political challenge. The ruling elite chose a development strategy of rapid industrialization via foreign investment by transnational corporations. The rationale was simple and logical: Singapore had no hinterland and few resources other than its people, and many of them were unemployed workers who were politically active. At the same time, Singapore was an experienced free port, with a good infrastructure and service facilities. TNCs would provide instant jobs, access to world markets, and

bring in new technology as well as management experience. To implement such a strategy successfully, a variety of incentives was introduced, along with a range of social programs.

The industrialization strategy adopted by Singapore coincided with the time of rapid expansion of TNCs and competition among them for offshore manufacturing locations. While Singapore's location attracted early investments by petroleum corporations, these capital-intensive industries did not solve the unemployment problems as had been hoped. A push was made for labor-intensive industrialization on the basis of low-wage costs. By locating light industries near housing estates, it was hoped that women would be drawn into the manufacturing sector in large numbers. Such a strategy proved successful.

By 1974, the workforce was concentrated in three low-skill industries: (1) electronics assembly plants (24% of the manufacturing labor force), (2) textiles (16%), and (3) wood and wood products (11%). The female labor force participation rate (percent of women in labor force) also increased from 31% to 49%, with most of that growth occurring in the manufacturing sector. Integration with the world market via these industries meant rapid growth in terms of value added, output, and employment.

The electronics industry has been vital to Singapore's success. In 1981, there were 185 establishments of "Electronic Products and Components" (code 384) employing 69,358 workers (Yearbook of Statistics 1982). Since at least 1972, there have been constant increases in output, value added, and direct export in the industry. Compared with other industries in Singapore, the electronics industry is number one in employment volume. The semiconductor devices industry (code 3844) employs 17,100 workers, with women accounting for 81.5% of the total semiconductor workforce (although they make up 91% of the production workers). The status of women in the electronics industry, however, does not reflect their position in the general labor force.

Labor force statistics show that women are concentrated in certain industries. They form the majority in textile, garment, electronics, domestic service, education, health care, and social welfare. The increase in women's work has resulted from government promotion (due to labor shortage in labor-intensive factories) and to social incentives (such as the family planning program). The jobs in which women are concentrated tend to be poorly paid, develop few skills, and provide few promotion opportunities (Lim 1982; Singapore Yearbook of Labor Statistics 1982).

An important segment of the Singaporean labor force is the "foreign guest workers." During the periods of economic boom, when a shortage of unskilled labor was experienced, many young Malaysian women, mostly of Chinese extraction, were recruited to take up the menial tasks in electronics and garment work. In the late 1970s, the recruitment efforts expanded to "non-traditional sources" - Indonesia, Sri Lanka, Philippines, and Thailand. Little data exist on the extent of employment of these foreign workers, but one report estimated 15% of the total labor force and a higher proportion of those in the manufacturing sector (Heyzer 1980).

Until recently, wages have not risen to keep up with inflation. This has been attributed both to "excess" labor supply in the 1960s and the deliberate policy of wage restraint, to attract foreign investment. Currently, the government has embarked upon a "Second Industrial Revolution," to upgrade the level of technology and labor skills.

In Malaysia, the communal tensions continued to dominate the political mood of the country after the secession of Singapore from the Federation. The ethnic division of labor persisted with the Malays in agriculture and government, the Indians in export agriculture, and the Chinese in petty commodity production. Foreign capital controlled 70% of the land and 60% of the manufacturing sector (M.H. Lim 1982).

In the wake of the race riots of 1969, the government began to reassess the entire question of economic growth in relation to vociferous Malay demands for a greater share in the country's wealth. As in Singapore, economic progress was seen as a solution to political problems. The New Economic Policy (NEP) was conceived to reduce poverty, especially in rural areas, and to reduce racial imbalance. Realizing that the limit of growth via import-substitution was being reached, the government began to seek industrialization based on expansion of exports.

Export-oriented industrialization (EOI) was adopted at a time when capital was becoming increasingly internationalized. By the time EOI was being initiated in Malysia, there had already been the early successes of Hong Kong, Taiwan, and South Korea to emulate. Malaysia followed them to Singapore, with the promulgation of various financial incentives for foreign investment. The state of Penang was the first to subscribe by developing in 1972 the Bayan Lepas Free Trade Zone (FTZ), the first one in Malaysia.

As long as there were no minimum wage laws and only a few urbanized areas with well-developed infrastructures, foreign investors located their factories around Penang and Kuala Lumpur. Drawing on the available workforce nearby, they hired a largely Chinese workforce. Nevertheless, since the major objectives of the NEP consisted of increasing Bumiputra participation in the market economy and of improving regional distribution of income and jobs, the Malaysian government had to play an active role in employment and industrial location policies. The government required the companies to hire a percentage of "Bumis" representative of Bumi presence in the general population at all levels of the company operations. The consequence has been one of extensive migration of Malays, especially women, into the urban areas, adding to those migrating to escape rural poverty.

In the 1970s, Malaysia also became a symbol of successful economic development in the eyes of the world. Spectacular growth was seen in the development of industrial zones, in female employment in labor-intensive assemblies, and in the manufacturing sector. Most of the new jobs were in electronics, textiles, and agriculture-based industries. In contrast to Singapore, the government has provided relatively little in the way of infrastructural supports and social welfare services.

In the 1970s, the island of Penang (the one state in Malaysia with a Chinese majority) was transformed from a declining port to a manufacturing center. The rationale for focusing on the manufacturing sector was similar to Singapore: the island lacked other natural resources, had a legacy of good infrastructure and urban services, the land cost was low, there was abundant supply of cheap but literate labor, and airport and port facilities existed, providing access to regional markets. In 1972, among the island's 400,000 people, some 15.18% of the labor force were unemployed. The Bayan Lepas FTZ was built near the airport in 1972, and by 1973, 22 firms in the electrical machinery, appliances, and apparatus group located there, accounting for 21.1% of employment.

With Penang as the leader through the 1970s, Malaysia saw phenomenal growth in the electrical/electronic industry. In 1974, 24 out of 35 firms in Bayan Lepas FTZ were involved in the manufacturing of electrical machinery, appliances, apparatus, and supplies. Throughout Malaysia, there was 54 such establishments (Ministry of Labor and Manpower 1980). In 1982, there were 172 firms involved in the manufacturing of household radios, electrical appliances, and miscellaneous electrical apparatus, employing 73,673 workers. Over the 10 years, Penang's population has also more than doubled, to 911,586.

Because the electronics industry employs large numbers of women, participation rate of the female labor force in the manufacturing sector is higher than the overall rate, 38.8% compared with 27.8%. For women aged 15 to 24 the female labor force participation rate is a high 46.9%. The rate is also high for all ethnic groups and for different marital status (Malaysia Ministry of Labor and Manpower 1980): 47.5% for Malays, 47.8% for Chinese, 50.4% for Indian; and 54.7% for Singles, 43.3% for Married. While women have historically worked in Malaysia, now they are working as wage labor in large numbers for the first time.

Future job opportunities, however, will be shaped by the controversial education policy. With the conversion to universal Malay-medium education complete in 1982, fluency in Bahasa Malaysia is now crucial to obtaining jobs. Such a policy effectively addresses the racial balance in the occupational structure. It also means that life opportunities for certain segments of the population -- especially Chinese and Indians from lower socioeconomic strata (who are usually educated in their own languages) - have become extremely limited.

Since 1965, both Singapore and Malaysia have become models of economic development. Yet in many ways they have strengthened some of the characteristics of the colonial period. The economic growth remains essentially foreign-propelled. The classes born under colonial rule have become more entrenched. The commercialization of the social relations of production has penetrated more sectors, although remnants of the pre-capitalist social formation are still important. While there has been expansion of middle class and of wage labor, petty commodity production still survives rather extensively, and the informal sector absorbs the shock of capitalist development.

Singapore and Penang have been very closely tied in history. Both islands were free ports set up by the British. While the legacy of racial mix is evident in both places, it is the Chinese who dominate. Both have pursued EOI agressively. Because of the historic development of urban infrastructures and commercial services, both have been favored by foreign investors. The electronics industry, particularly semiconductor assembly, has played a key role in the recent economic development of both places. Also, they have become successes relative to other LDCs and have been well penetrated by the capitalist system.

At the same time, the differences in Singaporean and Malaysian approaches to government intervention, in supporting economic development and in the social reproduction of labor, have made them unique environments to work and to live in. In Malaysia, the division of economic and political power along ethnic lines has dominated all aspects of policy development. Singapore, on the other hand, has been able to concentrate investments in social economic infrastructures because the aim was more focused -- on the consolidation of political power within an urban and island setting. These differences filter through to the lives of the electronics workers.

The Companies

The companies participating in the study are remarkably similar in production organization and technology, labor policies, wages, working conditions, and even physical plant. (See Table 10 for summary and comparison between the firms.)

Companies S1 and M1, in Singapore and Penang respectively, are subsidiaries of the same American corporation, SM. SM was formed in 1967 when a small transistor company in New England was combined with a fledgling integrated circuit company in Silicon Valley. From its inception, SM was committed to the successful strategy of producing the total spectrum of semiconductors. SM is one of the largest producers in the world today, with a specialty in integrated circuits. In 1968, S1 was set up in Singapore as the headquarters of Asia-Pacific operations. In 1972, M1, set up in Penang, was one of the first to locate in the new FTZ. By 1982, SM had production facilities in Scotland, France, Brazil, Thailand, Philippines, and Indonesia, as well as Singapore and Malaysia. In its Singapore and Malaysia facilities, assembly and testing are done on a wide range of products (memories, microprocessors, linear, digital logic, transistors, MOS) and packages (ceramic, hermetic, molded, hybrid). Its Penang operation being more highly automated, produces simpler products.

Company S2 in Singapore is one of the first manufacturers of semiconductors and was an early leader in research and development. Begun as an American company in Silicon Valley, it has recently been bought out by a European technology firm. Although the corporation still produces a variety of ICs, LSI products, and discrete components, it is not the industry leader it once was. S2 was one of the first to open offshore production facilities, and today its plants are located in Mexico, Brazil, Hong Kong, South Korea, Singapore, Indonesia, and Philippines. S2's Singapore

operations began in 1968 with a factory located within a housing estate. Singapore was chosen partly because of tax incentives and partly because of the appeal of government policies in general.

Company M2 in Penang is a leading Japanese diversified corporation, with a number of production facilities in Southeast Asia. The Penang plant set up in 1973, is involved in assembly and testing of ICs, memories, and transistors. A new, smaller plant is now being set up in a semi-rural area not far from Penang. The top level management is dominated by Japanese expatriates, in larger numbers than are found in American and European firms.

The Penang plant of Company M3 just celebrated its tenth year in 1983. The company specializes in ICs for military/aerospace uses, and has offshore plants only in Malaysia and Philippines. It does not see itself as a "pioneer" in "opening up" countries. The Penang plant is its most important offshore facility. The company chose Malaysia for its political stability, low cost, accessibility, infrastructure, and government incentives, in that order. M3 has the distinction of being the only company where wildcat strikes have taken place.

The production process is generally divided into three components -- assembly, end-of-line, and testing -- with each function including many tasks. The basic production flow is as follows:

1. Assembly: wafer mount -- scribe -- sort and plate -- visual inspection -- die attach -- 2nd optical -- lead bond -- 3rd optical

2. End-of-line: encapsulation -- tin-dip -- marking -- lead straightening -- final outgoing inspection

3. Testing: electrical -- temperature cycle -- centrifuge -- UV -- gross leak -- fine leak

While each step is based on complex technical principles, the performance of these tasks is extremely simple. Indeed, most tasks have been finely divided and each worker has only a few simple repetitive motions to perform.

All five companies in the study have established personnel policies and offer welfare services that are representative of the industry in the region and that reflect norms in the countries. While all serve the need for labor control in some way, the companies' policies and services can be divided into: (1) mode of recruitment, (2) workplace organization, and (3) reproduction of labor.

The hiring process is similar in all companies, recruiting female workers with minimum educational qualifications and work experiences. Contrary to earlier reports, the companies do not appear to have a conscious policy of screening out older, married workers, or ones with poor eyesight. Thus, the distinct profile of the workforce reflects the female labor market more than the discriminating nature of the industry. Once accepted for

employment, the applicants are assigned to production lines with vacancies. Except for S2, all workers rotate on three shifts. At S2, applicants have the choice of the permanent "graveyard" shift or day shifts with bi-weekly rotation. The hours of work are basically the same in all factories.

The basic pay is low when compared with the manufacturing sector in Singapore and Malaysia but is average for women workers. In Singapore, the basic pay is approximately S$250 per month; in Malaysia, it is about M$6.60 per day.[3] A variety of supplemental pay is possible: "scope" allowance (for those working on microscopes), shift allowance (while on evening and night shifts), relief allowance (cost of living adjustments), performance allowance (depending on ability to achieve target, both in quantity and quality), attendance bonus (for not taking sick leave), introduction bonus (for bringing friends who stay on to work). Given the range of incentives, the workers' pay becomes individualized (rather than graded or scaled by duties or seniority) rather quickly. Production quotas are widely used in all the firms in the study, although they do not apply to every job category. Each task and each product may have different targets -- so the target may vary daily for some workers. Currently, each job is being given two targets: one for quantity and the other for quality. The achievement of the daily target depends on the ability to work fast; with automated equipment, it is the pace the smooth functioning of the machine that determines whether the targets will be met.

Promotions are difficult to obtain, partly because operators, who begin with few skills, do not acquire many new skills on the job and partly because many supervisory positions are filled with outside applicants, who tend to have slightly more education. As for getting transfers, the practices vary. In the firms in Singapore, workers are shifted from line to line more frequently. As old lines are shut and new ones are opened, workers are transferred to where their labor is needed. In Penang, the workers appear to be more reluctant to have friendships broken up by transfers, and supervisors are reluctant to disrupt the production pace with new workers.

Should workers have any grievances, there are few channels for their resolution. In S1, a branch of the UWEEI (United Workers of Electrical and Electronic Industry) does exist, but rank and file participation is, by all accounts, low. In Malaysia, despite attempts at organizing, unions have been prohibited in the electronics industry.[4] Often, if a worker is unable to resolve a problem with a supervisor or cannot get transferred to another work area, she quits.

The companies often take pride in providing a range of benefits and services to the workers. In advertising for new workers, they give much emphasis to such benefits as: music piped into work areas, free uniforms, canteen, transportation, clinic, medical care, hospitalization insurance, recreational activities, classes, libraries, prayer rooms, and housing.

The services are not provided in the absence of their availability elsewhere. In Singapore and Malaysia, government medical care services are

inexpensive, but it is the norm for large TNCs to have a small clinic on their premises, to appoint a panel of private physicians from whom workers obtain unlimited free medical care, and to provide limited hospitalization insurance. The duties of the nurses are similar in that they provide first aid, screening, dispensary of non-poison (over-the-counter) drugs, and basic medical care. Their essential task is to make a judgement as to whether the worker is well enough to work and what needs to be done to make her well enough to work.

Most companies deviate little from one another in their services, wages, or working conditions. Some of these services are crucial for the maintenance of the labor force, such as health care, housing, and canteen. Some of these, such as the social and recreational activities and the music, are seen as morale-boosting. In providing all these services, the companies seek an image of a paternalistic benefactor. In both Singapore and Malaysia, the personnel managers regularly gather to compare notes. It is as if the services legitimize all else they do and make job change unthinkable to the workers. Yet it appears that workers' use of these services fall into two distinctive categories -- high use for those necessary for daily reproduction of labor (health care, canteen, bus, housing) and low use for those aimed at morale and socialization (recreational and education activities).

It appears that company services are provided not merely out of the attempt to indoctrinate and manipulate the workforce, as suggested by other writers, (e.g., Grossman 1978; Fuentes and Ehrenreich 1983). Instead, many of the services are quite essential to the reproduction of the labor force. Thus, the level and range of service provision are indicative, in part, of the lack of investment by government in the social infrastructure.

The Workers and their Health

There were a total of 903 surveys available for analysis, with 518 for Singapore and 385 for Malaysia. The survey and the interviews indicate the following about the electronics workers in Singapore and Malaysia:

- They are predominantly young women without substantial education; an increasing proportion are staying in the workforce after marriage and childbirth.

- Most work out of economic need and provide financial relief to the family, either through income contribution or alleviation of support burden.

- Compared to Malaysia, the workers in Singapore have had more work experiences, whether in a different industry, the same industry, or the same firm. They are also slightly older and more of them are married.

- The clerical workers differ from the production workers in having slightly more income, although their work-associated expenses are

also higher. In Malaysia, more of them have completed secondary education than production workers.

- In Malaysia, the Malays dominate among the rural-urban migrants. In Singapore, the Chinese from Malaysia make up the bulk of the migrant workers. In both countries, migrants are found more frequently among production workers than among the clerical workforce.

- While all three ethnic groups are represented in the workforce, the Chinese are present in proportionally smaller numbers than Malays and Indians among the production workers but in proportionally larger numbers among the clerical workforce.

- The Chinese workers tend to be slightly older and generally have a bit more work experience than the Malay and Indian workers.

- The workers earn below-average wages, although a variety of incentives can mean income significantly higher than basic wages.

- Except for migrants, workers live with families -- often extended families, who provide important household support services. In Singapore, workers aspire to, and do, buy public housing.

- For most production workers, meeting the production target is a central feature of work which some find difficult to achieve. Another central feature for nearly all production workers and some clerical workers is rotating shiftwork.

- Workers characterize their work as fast, pressured, and closely supervised. Some consider the work monotonous. Most do, however, receive assistance when needed, generally from fellow workers.

- Most workers spend their spare time on household activities. Some might characterize their lives as a dull routine -- from home to work to work, and then back home to work some more, before sleeping and starting the whole cycle again.

- Awareness of occupational health and safety is not high among workers, although most are aware of at least the names of substances to which they are exposed. Those working with microscopes, chemicals, and radiation are generally more interested in health and safety issues.

- Major reasons for labor turnover include microscope work and inability to adjust to shiftwork. This suggests a self-selection factor among those who remain.

- By and large, the workers are satisfied with their jobs, although the level of satisfaction with their lives overall is higher. More workers indicate an improvement, rather than worsening, in various aspects of their lives. Workers, however, would leave their jobs, given jobs with better pay or improved working conditions.

- Workers find that the most rewarding parts of the jobs are money and friends; some also indicate a growing sense of confidence and understanding of the world. An interesting difference, however, is that, whereas most workers in Singapore would stay in the workforce regardless of financial need, most workers in Malaysia would stay home instead.

These findings set the context for analysis of health problems. They also suggest that health problems should be examined in relation to the technical means of production, the social organization of work, and workers' patterns of consumption. Additionally, they suggest that different coping mechanisms and subjective outlooks are important in workers' health and well-being.

Analysis of workers' responses shows that the health problems reported by workers do not differ significantly across the companies and countries. The proportions are also fairly similar:

- About 50% in both countries report some form of illness in the last six months; nearly 50% in both countries have visited a health care provider within one month.

- Almost 75% in both countries have had symptomatic complaints of several days' duration since working in the industry.

- About 20% in both countries have had some form of injury from work.

In the absence of regional age-specific and sex-specific health data, it is difficult to ascertain how the workers compare with the general population, although it is expected that electronics workers would tend to be healthier than the general population, due to the health worker effect (i.e., those who are in the workforce are usually healthier than the general population). In Singapore, compared with the National Survey on Morbidity in 1976-77 which found 12.1% of the population between age 15 and 39 to be ill at any given point in time, electronics workers are in fact, less likely to be hospitalized, consult a provider, or be absent from work. On the other hand, acute respiratory infections are not nearly so important a cause for clinic visits, while skin and eye problems are more prevalent. This suggests that occupational exposures are important causes of health problems. Comparative data from Penang's Medical, Health and Dental Department's Annual Report in 1977 show that the electronic workers in Penang are also less likely to become hospitalized and less likely to seek medical care than the general public. On the other hand, the prevalence of specific problems likely to be due to occupational exposures, such as those of eye and skin, is higher.

To ascertain the extent to which ill-health is influenced by the technical means of production, the production and clerical workers were compared for the occurrence of injuries and illnesses. Analyses show that production workers have substantially more injuries and illness than

clerical workers (Tables 11 and 12); these results suggest that the nature of work is evidently important in determining workers' health, in terms of actual injuries and illnesses.

When specific symptomatic complaints are analyzed by job category, it appears that more production workers suffer complaints of the eye, ear, nose, throat, and musculoskeletal system than clerical workers. They also experience more sleep problems. The results point to the potential importance of microscope, noise, solvent, work position, work pace, and shiftwork in determining illness patterns.

Further analysis by work area shows that more workers in end-of-line and test areas experience injuries than those in other work areas, while fewer clerical workers experience injuries and illnesses. This suggests that the pattern of health is shaped by the technical means of production, and that specific symptomatic complaints should be examined in light of work area and specific exposure. It is reasonable to suspect that occupational exposure would be related to problems with eyes, ears, skin, nose, throat, respiratory system, reproductive system, and central nervous system.

When work areas are examined, some distinct patterns emerge. Workers in the assembly area and workers who are in the leader and QC (quality control) categories are more likely to have eye complaints. Workers in the end-of-line and test sections are more likely to complain of musculoskeletal problems. Workers in end-of-line and leader/QC are more likely to have nose, throat, and skin complaints.

As for gastrointestinal, sleep, central nervous system, respiratory, and psychological complaints, there were no consistent patterns between the two countries. These results might suggest that the microscope causes problems for workers who are in or have been in the assembly area, that repetitive motions and uncomfortable positions may be responsible for musculoskeletal problems among workers in end-of-line and test areas, that solvents and other chemicals may be responsible for workers in end-of-line and leader/QC positions experiencing nose, throat, and skin problems. At the same time, however, gastrointestinal, sleep, central nervous system (CNS), respiratory, and psychological problems are not related to the technical means of production.

Since many workers, especially those in Singapore, have worked in other industries or other work areas, previous occupational exposures may be responsible for current health problems. Analysis of various health indicators by occupational history shows that a much higher proportion of women assembly workers has eye problems than that of women who have worked elsewhere, as indicated in Table 13.

Table 14 further specifies the proportion of those who have worked in assembly and who had to obtain eyeglasses. In Singapore, 17.2% of those who worked in assembly obtained glasses, compared with 2.5% of those who had no previous assembly experience. In Malaysia, 7.3% of those formerly in

assembly had glasses, compared with 2.9% of those without assembly experience. These results again suggest that microscope work is related to eye problems, to eyesight deterioration in particular. Indeed, about 20% of those who have worked in assembly had to obtain glasses.

Table 15 reaffirms that those who use microscopes (or video display terminals) are more likely to suffer eye complaints than those who do not. In fact, those using microscopes are almost twice as likely to have eye problems. In Singapore, 25% of those currently using microscopes reported having to obtain glasses, while only 5% of those not using microscopes reported similarly. In Malaysia, 21.3% of those currently using microscopes complained of blurred vision, while only 2% of those without microscope work complained.

The musculoskeletal (M/S) problems were primarily hand and wrist pain and back and shoulder aches. Table 16 shows that those who perform repetitive motions, lift, and strain, or who continuously stand or sit are more likely to suffer aches and pains than those who do not. In Singapore 32% of those who had to reach and sit or stand all day reported back and shoulder aches. Those without this exposure reported low prevalence levels -- 2% with pain and 3% with aches. The physical strain problem is spread across various jobs from clerical work to assembly to testing. The source of the problem appears to lie in both ergonomic design and pace of work. Those with M/S problems report working in uncomfortable positions, having to work fast, and doing monotonous work.

Exposure to various substances was analyzed in relation to symptomatic complaints. Tables 17 through 20 show that skin problems (rashes and dryness), nose and throat problems (chronic runny nose and frequent sore throat), respiratory problems (tightness of chest and shortness of breath), and central nervous system problems (dizziness, weakness, frequent headaches) are more commonly reported by workers who regularly use chemicals (such solvents and cleaners as TCE, IPA, acetone, freon, epoxy, acids, and flux) in their work.

Because a weak relationship was observed between job category and reproductive health problems (production workers report more problems with menstruation, pregnancy, and offspring), these problems were analyzed first by work area and then by exposure to substances. Analyses by exposures, as indicated in Tables 21 through 23, show that workers regularly using chemicals are more likely to experience problems with menstruation (pain, irregularity, and heavy flow), pregnancy (infertility and miscarriage) and offspring (premature births and birth defects).

Among those reporting menstrual problems, pain and irregularity were the problems most frequently reported. Of the pregnancy problems, those exposed to chemicals mostly reported miscarriages, while infertility problems were divided between those exposed to microscopes and those with no exposures. The reported offspring problems were mostly premature births. Only married women are included in the analyses of workers reporting pregnancy and

childbirth problems. The majority of problems regarding chemicals arose with workers using TCE. Of those using chemicals and reporting menstruation problems, laser exposure appeared to be important next to TCE usage. Overall, the numbers are too small to make definitive statements. It does appear, however, that reproductive outcome and exposure to TCE warrant closer attention.

Through the various analyses discussed above, a tentative conclusion can be drawn that the technical mean of production presents a variety of health hazards. However, given that the interviewees gave considerable emphasis to the problems they face in the organization of the production process, it is appropriate to consider the effects of shiftwork, production quotas, and other aspects of the social organization of production.

Shiftwork has been found to be related to a host of health complaints in the literature (e.g., Tasto et al. 1978; Angersbach et al. 1980). In this study, shiftwork appears to be related to sleeping problems (difficulties falling asleep and waking up without cause), as seen in Table 24. Gastrointestinal problems (diarrhea, gastric pain), central nervous system complaints (weakness, dizziness, frequent headaches), and psychological complaints (boredom, loss of appetite, upset stomach, headaches, insomnia) are also related to shiftwork, but the relationships are not statistically significant.

It should be noted that, since most clerical workers do not have shiftwork, the differences discussed between shiftworkers and non-shiftworkers reflect, in part, differences in job categories (and exposures). At the same time, however, it should be noted that no difference in sleeping and gastrointestinal problems was observed when analyzed by technical mean of production. Examination of shiftwork status, especially in Singapore, suggests that the fact of rotation is more important than the hours of work in generating health complaints.

Health complaints are also analyzed by (1) whether the workers had to meet production quotas and (2) the frequency with which the workers had trouble meeting the production quota. In Malaysia, workers with production quotas reported slightly more musculoskeletal and sleeping problems. No differences were found among Singaporean respondents. On the other hand, in both Singapore and Malaysia, workers who frequently have trouble meeting targets had more musculoskeletal, respiratory, and psychological complaints than those who seldom have trouble meeting targets. In Singapore, workers who have frequent trouble also reported more sleeping and CNS problems. These results indicate that there is a strong subjective element influencing workers' health. The structure of the production quota system may not be so important as workers' ability to meet targets or the perceived consequences (social and economic) of their not meeting targets.

The symptomatic complaints were further analyzed by other aspects of the social organization of work -- pace of work, speed of work, time pressure, closeness of supervision, relations with other workers and supervisors.

Aside from musculoskeletal problems being related to pace and speed of work, as discussed previously, the only consistent relationships found between the two countries involve working under time pressure and experiencing psychological complaints, and health visits and illness experience, as shown in Tables 25 and 26.

Among those working under time pressure, frequent headaches and nervousness are the most notable psychological complaints. Those reporting time pressure are more likely to experience respiratory and skin problems. Those who reported illnesses of "hysteria" or "nervous breakdown" all reported working under time pressure. As for increased health visits, increased skin problems suggest that speed contributes to carelessness in materials handling. Headaches and giddiness are also important causes of these visits.

While no other consistent relationships were observed, gastrointestinal complaints seem to be the most significant. In Malaysia, gastrointestinal complaints appear to be related to speed of work (having to work fast), not getting help from the supervisor, and working under close supervision. In Singapore, a weak relationship was noted between gastrointestinal complaints and speed of work and working under time pressure. In Singapore, sleeping problems were also weakly related to working under time pressure and being closely supervised. These results suggest that occupational stress is of concern.

The results discussed above suggest that the technical means of production is responsible for more health complaints than the social organization of work. At the same time, both are related to specific health problems. It is, however, necessary to understand the influences of non-work factors, such as demographics, lifestyles, and other issues of consumption. It is also important to understand whether and how consumption is related to production.

More migrants reported psychological and sleeping problems than non-migrants, as Tables 27 and 28 indicate. This suggests that the migration experience may be stressful and may be felt through boredom, loneliness and lethargy, as well as sleeping and gastrointestinal problems. In Malaysia, more migrants also reported experiencing a variety of symptoms (gastrointestinal, CNS, respiratory, skin, and eye problems), visiting health providers and taking sick leave. These findings may relate not only to migration but also to segregation in work areas and lack of mobility within the firm.

Indeed, when analysis which takes job category into consideration is done, the migration effect decreases substantially. When shiftwork and migration are both considered in relationship to CNS and psychological complaints, shiftwork exerts a slightly more important influence than migration in both Singapore and Malaysia. Thus, the influence of workplace appears to be stronger than the experience of migration.

Within each ethnic group there is still a health differential between clerical and production workers. That is to say, production workers are more likely to become ill and report symptomatic complaints. At the same time, the Chinese workers appear to be healthier, compared to other ethnic groups in the same job category, as seen in Tables 29 and 30.

Married workers now make up the substantial portions of both the clerical and production workers. More married workers tended to be off sick and visit health providers, as seen in Table 31 and 32. These may be related to the fact that married women often also have to carry out more household duties. In working a two-job, two-shift day, fatigue, frequent colds, and headaches are not surprising.

It is the hours and the physical and mental demands of work that dominate the workers' lives. As most work a 5-1/2- or 6-day week, their spare time is limited. A majority of the workers in both countries report that they spend their spare time doing housework and childcare, which suggests that the double burden is quite heavy for most of these women. Other spare-time activities can be grouped into rest and recreation (e.g., shopping and movies) and solo activities (e.g., sleeping and reading). While the burden of housework is heavy, there are substantial differences in how workers spend their spare time, according to marital status and ethnicity, as suggested in Tables 33 and 34. In both Singapore and Malaysia, married workers definitely have more household responsibilities and less time for rest and recreation. This situation is even more marked in Singapore, where extended family residences have been broken up by the government's policy of housing development and population relocation.

In both countries, it is the Chinese workers who have fewer household responsibilities and hence more time for rest and recreation. When analyzed together, there remains a difference between single and married workers for each of the three ethnic groups. The only influence related to job category is that clerical workers of the same ethnicity and marital status have more time for rest and recreation, as can be expected from their work schedule.

The less amount of time spent at housework may very well explain why the Chinese and the single workers are generally healthier, as shown by various indicators. Those who find time to shop, visit friends, and see movies appear not only to have fewer demands on their physical and mental energy but also to receive the benefits of greater social support.

Of course, rotating shiftwork almost destroys the possibilities of an active social life outside of work and family circles. For those workers whose husbands also do rotating shiftwork, it often means they do not see each other for weeks. For those who have hopes of further education, it is virtually impossible to find classes that meet at compatible hours. Most of the interviewees expressed these dilemmas. Most of them also say they often have to make a choice to get a bit of extra sleep instead of fostering friendship. Yet that extra bit of sleep may not even be very restful in the tropical heat, traffic and street noises, and crowded living conditions.

Despite the multiple demands on their lives, almost none of the respondents have acquired such modern coping mechanisms as smoking and drinking. There are a few respondents who reported taking sleeping pills -- just as a few interviewees related about their friends -- but drug abuse is apparently not a problem among these women workers. Caffeine intake in the form of tea and coffee, however, is very high, though their consumption is definitely within the social norm. Malaysian workers who consume tea and coffee regularly also reported more gastrointestinal and sleeping problems than those who did not consume caffeine. Tea and coffee intake is much higher among those working rotating shifts in Malaysia; this confirms the findings reported in the shiftwork literature (e.g., Tasto et al. 1980; Angersbach et al. 1980). It also helps to explain why shiftworkers report more gastrointestinal and sleeping problems.

The food intake of workers is not always home-cooked or properly prepared, as their demanding work schedule puts limits on available time. One out of four workers in both countries does not eat regularly. One meal in five is eaten out, most often at a hawker stall; and a quarter of their snacks are taken at hawker stalls, while a third of their snacks are packaged food. Depending on the family financial burden, some interviewees report being able to buy meat only once a week.

Shift rotation is a major factor affecting meal intake. In both Singapore and Malaysia, regular meal intake can be disrupted by the work hours, as seen in Table 35. While the data are based on meal intake in the 24 hours previous to the survey, it is interesting to note that shiftwork alters meal patterns, with the hours of work being more important than the fact of rotation. This is supportive of the interviewees' responses -- that they lose their appetites and skip meals when they are working the graveyard shift.

Meal intake schedules are closely related to gastrointestinal complaints. Table 36 shows that those who reported not eating regular meals experienced more gastrointestinal problems.

Gastrointestinal problems are, however, also related to souce of food. Workers were asked to indicate the major source of their meals and snacks in the 24 hours previous to the survey. Table 37 shows that those who had eaten at the factory canteen or at hawker stalls experienced more gastrointestinal complaints. These findings suggest that food handling and sanitation is most likely still a problem, especially in Malaysia. The data also indicate that a considerable proportion of workers consumes packaged "junk food."

In addition to understanding the factors that influence ill health, it is also important to understand the coping mechanisms of the workers, since the subjective outlook of workers has already been shown to be relevant to their health. The patterns of spare-time activities, levels of job satisfaction, and reasons for leaving the job expose these outlooks. Spare-time activity patterns are related to their work, ethnicity, marital status, and occupational history.

Subjective factors, especially job satisfaction, were found to be important in health problems. In both Singapore and Malaysia, there was a steady gradient between levels of job satisfaction and occurrence of illness and gastrointestinal, CNS, and psychological complaints. Gastrointestinal, CHS, and psychological complaints can be construed as all stress-related.

Reasons for leaving the job relate to some interesting antecedents in both countries. Single workers are more likely to leave for better paying jobs and improved working conditions, while married workers are more inclined to work until retirement. This reflects the fact that fewer single workers have economic burdens and that many married workers continue to work out of economic necessity. Graveyard shift workers in Singapore, most of whom work these odd hours out of necessity, are also more inclined to continue working until retirement. As the interviewees indicated, many fear that their age and lack of education would render them unemployable if they quit. Clerical workers, compared with production workers, are also more inclined to leave for better wages; this reflects their sense of having more skills and desiring not to be in factory work.

Workers who have not had previous employment experiences or who have not been transferred among work areas in the same firm are much less willing to leave for better wages. Interview evidence suggests that those without varied employment experience lack confidence and fear changes in work circumstances. By the same token, those who have been moved around are more likely to take on new changes and challenges.

Several issues stand out in reviewing these various predisposing factors for well-being. One is culture -- that ethnicity means different outlooks and expectations. Another is working life -- in the form of job category, shift rotation, and job experience. A third factor is marital status. These issues affect both time management and outlook.

The results of the analyses of the various factors influencing health and well-being can be summarized as follows:

- Production workers are more likely to experience injuries and illnesses and to take sick leave than are clerical workers. They are also more likely to report eye, ear, musculoskeletal, nose and throat, and sleep complaints.

- The end-of-line area is the most hazardous work area measured by injuries, illnesses, and a variety of other complaints. This situation is likely to be related to the use of a variety of chemicals and machinery. The assembly area, however, is where eye complaints are generated.

- The physical working environment has direct influence on the health conditions of workers in specific work areas. These include: microscope on eye sight, chemicals on skin, noise on hearing, and ergonomic design on the musculoskeletal system. Musculoskeletal

problems are increased by the pace and speed of work. There also appears to be a relationship between chemicals and problems of nose and throat, respiratory system, and central nervous system. Lack of temperature comfort and exposure to dust fumes further contribute to respiratory problems, and exposure to solvents relates to problems with menstruation, pregnancy, and offspring.

- Workers also experience stress-related problems that appear to stem from the organization of work. Shiftwork, especially rotation, is related to gastrointestinal, sleeping, CHS, and psychological complaints. The time pressue of work also contributes to a higher prevalence of psychological complaints, illnesses, and health visits.

- Migrant workers report more psychological, sleeping, and gastrointestinal complaints. This suggests that a break in social supports can lead to stress-related problems.

- Married workers are more likely to visit health care providers, take sick leave, and report CNS complaints. The fact that their age is not substantially higher suggests that their greater household responsibilities allow less time for recreation and relaxation. Analysis of spare-time activities bears this out.

- Gastrointestinal problems reflect not only occupational stress but also the workers' life-styles and social support systems. Migrants report more gastrointestinal complaints, as do workers who experience lower levels of job satisfaction. These complaints are also strongly related to irregular meal intake and eating out (where food sanitation is questionable). Noting that irregular meal intake is related to rotating shiftwork, one can understand how work demands shape lifestyles; the work schedule forces workers to "eat and run" whenever it is convenient -- a practice which results in gastrointestinal problems.

- Shift rotation contribues to ill-health in ways other than disrupted sleep and meal schedules. Rotating shiftworkers report spending more time on housework an less time going out and visiting friends than workers with fixed hours. This means not only less time for relaxation and recreation but also less social contact outside of work and family.

- Lower levels of job satisfaction are related to more illness and CNS and psychological complaints. This fact suggests that the subjective outlook of workers is quite important to their health and well-being.

- That the Chinese have fewer health complaints overall may be related to several factors. Relative to the Malays and Indians, the Chinese spend less time on household chores and more on recreational activities. While family obligations are strong for all three

ethnic groups, the economic obligations in the Chinese family appear to be more important than those of traditional social roles. More specifically, the Indian and Malay families first constrain their daughters' educational and working opportunities and then expect them to carry full family responsibilities while working. In the Chinese family, the daughter works to contribute to the family and in doing so becomes respected in her own right. Hence, the Chinese workers express a more economic rationalist orientation about their jobs. They are also more outwardly confident. Therefore, the subjective orientation may be an important mediating factor.

These findings suggest a complex set of interrelationships between workers' health, their living and working environment, and their outlook on life. It is also becoming evident that work and health are not separate from social institutions (family and culture) and the economic imperatives of industry.

Summary and Conclusion

Women electronics workers have attracted international attention since the 1970s for a variety of reasons. These workers represent the historical precedence of Asian women entering manufacturing industries in large numbers and proportions. The electronics industry has been a leading sector not only in the economic development of the women's countries but also in economic restructuring throughout the world; however, the industry has achieved its success through the exploitation, in the economic sense, of the women workers. Much of the literature, both academic and journalistic, points to a workforce that is too inexperienced and too uneducated to realize that its low wages and long hours are the basis of industry profits.

Workers' health is of interest, for its maintenance is a necessary contributing factor to the stability and productivity of the industry's labor force. In addition, the state of health and well-being also reflects the social and industrial condition of life. On the basis of the occupational health and social epidemiology literatures, a variety of health problems among women electronic workers might be expected. At the same time, however, these suspected health problems might counterbalance the improved standard of living and other social and economic opportunities that are integral to entering the workforce.

Taking a political economy of health perspective, this study seeks to understand the relationship between the micro-level functions of workers' bodies and the macro-level dynamics of capital accumulation. Insofar as the present attempt is concerned with the search for mediating structures that lie in diverse spheres of life -- labor process, family, community, and culture -- the framework proposed is one where health is shaped by the labor process, which reflects both the technical and social organization of work, and which embodies the social, political, economic, and cultural institutions of society. The survey reveals a host of health problems which can be related both to specific aspects of the work and to general patterns of consumption.

The present study confirms some of the anecdotal evidence of occupational health problems. It also suggests that lifestyles are closely related to work demands. It is particularly curious that, while workers tend to focus their complaints on issues of workplace organization and on problems in labor-management relations, more health complaints appear to reflect physical hazards rather than psychological problems.

Workers using microscopes not only complain of sore eyes more than other workers but also are more likely to experience blurred vision and to require glasses. Sharing of microscope lenses has also led to a spread of conjunctivitis. This has been a major problem since the early days of the industry. However, as automation is introduced, video display units are replacing microscopes, and as each worker has to work several machines simultaneously, the eye sight problem may decrease with the next generation of assembly workers.

Alcohol, acetone, TCE, freon, and other cleaners and solvents are used in a wide variety of operations. These substances are associated with dry, itchy skin and rashes. Where molding and tin-dip operations are still manual, similar skin problems are found. There is also evidence that exposure to solvents may be related to menstrual irregularities, miscarriages, and premature births. Sore throats, runny roses, and chest tightness are also more often reported by those who complain of unpleasant odors and poor ventilation. While some companies are paying greater attention to engineering controls that could minimize the exposure, a substantial proportion of electronics workers remains at risk.

The physical design of work areas and the pace and speed of work constitute the third area of occupational hazards. Pain in hand, wrist, and arm, and back and shoulder aches are more likely to be reported by workers who perform repetitive tasks and who must work at high speeds. The lack of awareness among workers and health providers often results in lack of diagnosis of repetitive strain injuries. These problems are likely to be exacerbated by the burden of household chores. A large proportion of both production and clerical workers are affected by these problems. While automation does relieve some of the strain, much remains to be done to prevent and reduce the problems of strain.

Heat and cold are experienced by workers in areas where machines are operating or where air-conditioning is necessarily cold to keep machines functioning. Workers in these areas tend to report more respiratory problems. Noise is another physical hazard in the industry, although the number of affected workers is relatively small. Safety problems, experienced by a slightly greater number of workers, are concentrated among those working in the end-of-line areas.

The organization of work is also related to various health problems. Working under time pressure and close supervision -- due to production quotas and a wage system that is hinged on meeting targets -- means increased sleeping, gastrointestinal, and psychological complaints. On a

day-to-day basis, workers seem to be the most preoccupied with the terrifying and arbitrary authority of supervisors and with meeting those targets which ultimately control their incomes.

Because nearly all workers in the study experienced similar work pressures, the specific effects of job demand, decision latitude, and other dimensions of workplace organization could not be clearly ascertained. Interviewees indicated that work pace vacillated between high pressure and boredom. Also, there were differences among firms in terms of task variety; however, most of the workers were more concerned with supervisory support and the wage incentive system. While these aspects should be further investigated, it does seem that the world views of the workers are important in defining sources of occupational stress. This is to say that most of the workers, as women from the working class or from a rural background, had few aspirations about promotional prospects, job involvement and control, and autonomy on the job. Their concerns stem mostly from the economic need for work and the social environment within which they work and on which they depend financially.

Rotating shiftwork appears to be the major aspect of work organization that gives rise to health complaints. Sleeping problems, especially insomnia, are related to the fact of rotation more than to the fact of shift. Gastrointestinal complaints, especially gastric pain, on the other hand, is related more to the hours of work. Shiftworkers consult health providers more often, sustain more injuries, and have higher absenteeism.

Shiftwork and gastrointestinal problems provide the best illustration of how lifestyle is tied to work demands. That shiftwork disrupts family and social life and hinders educational and advancement opportunities is well articulated by the workers. Shiftwork disrupting sleeping schedules and regular meal intake is also documented. Among the electronics workers, it is found that when shiftwork demands a quick meal on the run, workers tend to eat at hawker stalls, which they can most comfortably afford on their income. Food sanitation, however, remains a problem resulting in gastrointestinal complaints. Shiftwork is also related to increased caffeine consumption, which is also related to sleeping and gastrointestinal complaints.

Exit interviews identify the highest number of resignations as related to shiftwork. Interviewees suggest that some workers adjust faster than others. While the shiftwork literature suggests that longer periods of rotation are preferable for reasons of circadian rhythm periodicity, climatic conditions in tropical Asia complicate the issue. Many workers find sleeping during the daytime to be almost impossible for reasons of heat, traffic noise, and crowded living conditions. Workers with physical exhaustion are likely to decrease social activities with friends from pre-factory days. Thus, the social circle and social life become more confined to the workplace and the family.

The general lifestyle of the workers is one shaped by the demands of the shift system, on the one hand, and by the family system, on the other. The

majority of workers spends spare time at home, on household and family duties. Married workers are more likely to experience general health complaints, probably due to the burden of the double day. Migrant workers, having fewer family obligations than those living with their families, do get more rest and recreation time. Nonetheless, being separated from their social support networks and not always welcomed by their new neighbors, they do report more psychological complaints than workers of local origin. But the problems facing migrants go beyond the question of social networks. Coming from rural environments that are predominantly of a single culture, migrant workers face greater conflicts and social adjustment problems in multicultural environments and urban lifestyles, than workers from urban environments.

The cycle within which workers seem trapped now becomes evident. Coming from a background of poverty, a young woman with few skills manages to find a job in a factory. The wage, although low, is a real asset to herself and her family. Since the wage system is based on a variety of incentives, she can work hard to increase her income, but that income will be limited by her ability to produce. With shiftwork, she has few opportunities to increase her education. Shiftwork dictates her eating, sleeping, and socializing hours. She cannot acquire sufficient skills to obtain another job. Also, she was likely educated in her native language -- another barrier to her job opportunities. She can leave if she is willing to sacrifice her earnings. She can relax in the job if she is content with low basic wages. Within a short time, not only does her daily life revolve around the shiftwork schedule, but also her career is trapped in the factory. She can find comfort and support in her family, but her family also places substantial demands on her, both financially and for household work. In time, she is likely to find that her health is the one aspect of her life that has deteriorated during her work in the electronics industry.

It is interesting to note the differences between Singapore and Malaysia and between the Chinese and other ethnic groups. The Malays and Indians tend to report more health problems than the Chinese. More Chinese report rest and recreation time, while more Indians and Malays spend spare time on household duties. This is one aspect of the explanation. This is also tied to the nature of the family in these cultures, as illustrated by Malays and Indians being willing to leave their jobs for marriage while the Chinese would leave for higher pay. Whereas Indian and Malay families tend to restrict their daughters' attendance in schools and entrance into the workforce, Chinese families tend to push their daughters into contributing economically to the household. Once working, however, daughters become more respected in the family. This rise in status in the family results in a different outlook toward the job and different burdens to shoulder. The Chinese came to Malaysia as traders and wage laborers; they have been enmeshed in capitalist relations for much longer than Indians and Malays. Those perspectives are embodied within the family. For the Chinese daughter, the contradictions between tradition and modernity are much fewer than for the other ethnic groups. Indeed, job satisfaction in LDCs may indeed hinge on the successful adoption of industrialism as a way of life, and the Chinese have been incorporated in it longer.

The difference in health status between Singaporean and Malaysian workers can be explained in part by the general standard of living, which is related to chronology of capitalist development and workers' backgrounds. That is to say, Singapore provides, generally, better housing, transport, and health care than Malaysia, in part because of opportunities afforded with a small geographic area and in part because of greater incorporation into the capitalist system. By the same token, workers from Malaysia's rural areas are less likely to have experienced modern sanitation and health care than workers from urban environments. The interviews, however, suggest a further difference. In Singapore, more workers appear to have self-confidence and to value work as a learning experience in ways that workers in Malaysia did not express. The workers in Singapore experienced more transfers within the company and job changes than those in Malaysia. In fact, workers in Malaysia refused promotions in order to stay on the line with their friends. These experiences appear to have been important in effecting changing values and outlooks. Furthermore, work opportunities for women in the modern sector appear to be more plentiful in Singapore. It appears that capitalist development in Singapore has proceeded further in its penetration of society. Though still secondary, the status of women, especially in the labor market, appears to be changing faster than in Malaysia. Thus, it can be suggested that the subjective outlooks of workers, which mediate health outcomes, embody not only job satisfaction but also the changing role of women as offered by industrial development.

A further mediation role can be attributed to health services and occupational health policies. In both Singapore and Malaysia, the companies provide primary care services as well as occupational health services. The main role of the factory clinic is to keep workers well enough to continue productive activities. To this end, the clinic (and its free services) serve an important reproductive function. In doing so, however, the clinic also becomes an arena for labor struggles. The nurses are, on the one hand, the ones who ease pain and hurt and who provide comfort and advice. On the other hand, they are an extension of management. The workers realize that, without other channels to solve grievances, ill-health is their only legitimate excuse for withdrawing labor. Health, then, becomes a negotiated process rather than a defined outcome.

The varied degrees to which the factory health service is involved in occupational health are dependent upon pressures from both headquarters and the government. In this respect, Singapore is quite different from Malaysia. In Malaysia, officials in the Department of Factories and Machinery speak quite openly not only about shortage of staff and funds but also about the government's fear of antagonizing foreign investors. Regulations, to the extent that they exist, are seldom enforced. The explicit prohibition of unions in the electronics industry further signifies the government's stance. In Singapore, along with increasing wages, introducing skills development programs, and embarking upon a "Second Industrial Revolution," the government has also actively begun to promote occupational health and safety. Many companies are now introducing biological and environmental monitoring and are employing new engineering

controls as physical plants are upgraded. The effects of these actions, however, will not be seen for some time.

The research shows that, indeed, the forces impinging upon one's health and behavior are numerous. For electronics workers in Singapore and Malaysia, the technical means of production, the social organization, and the patterns of reproduction combine to influence workers' health. While particular exposures have specific health impact, the results of the combination of exposures differs according to the job being done. At the same time, the workers experience similar pressures from factory discipline and similar conditions for their reproduction. The family is a pivotal institution in providing for reproduction. The state plays a key, if indirect, role through both social and economic development policies.

Insofar as health is a reflection of a society's potential to reproduce, the study has shown that, in Singapore and Malaysia, workers' health is decreased by their contribution to the total economic development strategy but that the restoration of health is privatized in the family. The struggle to maintain equilibrium is centered at the workplace.

Insofar as the study suggests the importance of subjective factors, the changes in the labor force must be noted. The electronics workforce in Singapore and Malaysia is still made up largely of young, single women who lack educational and work experience; however, they are getting older, getting married, and becoming more educated. Many workers have been working as long as the industry has been there. In that time they have become wives and mothers and stayed in the workforce. They have experienced retrenchments and, consequently, changes in companies. As forward linkages occurred in the production process, many have gained more confidence about themselves -- in their ability to find employment, to get along with people of different backgrounds, and to understand the "games" played at the workplace. They have also come to realize that while their families and economic burdens have grown, their job opportunities have not. They have acquired only a few transferrable skills. While the older workers tended to have completed, at best, lower secondary schools, many of the newer ones have completed secondary education, especially in Malaysia. The older workers describe the newer ones as being more stubborn and choosy -- that they accept authority and direction much less readily. More of the younger workers also have hopes of getting out. More of them enroll in courses to acquire new skills to the extent allowed by shiftwork.

Working experiences, coupled with changes in society, have brought changes to women's outlooks. Increasingly, work is no longer a temporary, pre-marriage phenomenon. While the economic need to work is still the primary motivation, women increasingly realize that work also means being valued as productive beings. Thus, values central to capitalist development are becoming internalized. Working on the assembly line with mixed ethnic groups has begun to break down the colonial legacy of ethnic segregation on the one hand, and to build a new multi-cultural working class on the other. The interpersonal relationships found at work constitute a new form of

social relations for women. While Indians and Malays speak at length about new friendships established on the assembly line, the Chinese are more concerned with income. Their status within the family has risen as their income-earning ability increased. The transition to the factory-centered life has been most natural for the Chinese. Having come to Singapore and Malaysia as traders and wage laborers, the Chinese had already been enmeshed in capitalist relations. The disenchantment of clerical workers with factory work in Singapore suggests rising expectations of employment opportunities and a discriminating hierarchy of those opportunities.

Perhaps the most striking difference in how people viewed their jobs and work in general is found between Singapore and Malaysia. In Malaysia, many production workers aspired to become clerical workers, since they showed considerable pride in their position in life. In Singapore, many clerical workers were quite disenchanged, for they desired jobs outside the factory. In Malaysia, workers worried about job security and wished for employment in the government sector. In Singapore, many wished for retrenchment in order to start anew in another job and receive severance pay upon leaving. In Malaysia, most workers identified money and friends as important job factors; however, they would choose to stay home if they did not have the financial need to work. In Singapore, while money and friends were important, more were inclined to identify a broadening of horizons as an important aspect of working, than workers in Malaysia. Indeed, most indicated a desire to continue working regardless of financial need, suggesting that work has meaning at an abstract level.

Although working conditions and management practices are relatively similar across companies and countries, they too were changing. With each economic downturn, labor was being replaced by machines. As machines increased, the proportion of women workers began to decrease. Increase in the use of machines also led to higher production targets, but the targets, no longer tied to a person's dexterity, were now tied to the machines. While supervisors still remained central authority figures (if not authoritarian), the machines provided a buffer against management demands on productivity. In other respects, however -- from being allowed to see a nurse to being given a promotion -- it is still the supervisor who dominated workers' lives. It is the combination of financial incentives and direct supervisory authority that has kept workers working. By and large, corporate paternalism was recognized by workers as insincere. Workers readily accepted what was useful to their existence, such as health care and transport, and rejected what was not, such as sports and other social activities. Even though workers' labor could be bought, their loyalty could not. Workers accepted, even preferred, separation between their social and economic lives.

With respect to the physical working environment, changes can also be noted. Over the past few years, the companies have become increasingly concerned about health and safety issues, largely in response to pressure from headquarters. With the physical plants being new and therefore in reasonable condition, more attention has been paid to safety guards on

machines, to automation, and to periodic biological monitoring. An increase in trained health and safety personnel has become evident, especially in Singapore. The production demands for air-conditioning and a relatively dust-free environment do make it a relatively attractive workplace. Workers prefer electronics to textiles; they also prefer TNCs to indigenous companies.

These changes in the workforce and in workers' outlooks reflect developments in the industry as well as in the two countries of concern. In the years since the industry first located in Asia, there have been tremendous growth and changes in the industry and in the region. Automation possibilities, compared with a growing regional market, has led to forward linkages in the production process, thus making factory work a more diverse experience. With increased capital investments and a more diversified production of sophisticated products, the companies have become less "footloose." As their initial tax holiday has come to an end, most companies are increasing their investments rather than pulling out. More locals are being hired to take over positions formerly occupied by expatriates. With growing industrial development and economic diversification in these countries, the electronics industry is beginning to shed its enclave character.

There is no doubt that the electronics industry has contributed to capitalist development in these countries. That women are entering the formal sector labor force is a phenomenon without historical precedence in Singapore and Malaysia. The success of the low-wage labor strategy has been possible in part because the cost of production has been born by the household. The reproductive net is cast over large areas, covering urban and rural households as well as international migrants. In Singapore, in particular, the state has also played a crucial role in its social policies, including social control. In both countries, strict regulations governing trade union activities have also been essential in suppressing labor demands. In addition, traditional ideologies governing women's roles have contributed to workers' concern with family, rather than with working life. In both Singapore and Malaysia, it is women's work -- paid and unpaid -- that has been central to the growth of the industry and economic development in these countries.

The changing values that women hold, however, are not necessarily matched by changes in the social order. That new workers in Malaysia have much greater education than older workers suggests that job opportunities for women have not diversified. The continuing burden of household work, especially for Malay and Indian workers, suggests that traditional values are slow to change. For these workers, the conflict between modernity and tradition is much greater than for the Chinese.

That the living and working conditions faced by women electronics workers echo those experienced by women textile workers of the 19th century points to a replay of historical processes (Tilly and Scott 1976; Berch 1976; Dublin 1979). That women today constitute the workforce which bears the brunt of economic necessity parallels, again, the experience of women

workers in the 19th century and reinforces the notion of women as a marginal labor force. That women are concentrated in certain industries today, as in the 19th century, suggests women's secondary status in the labor market.

The similarities continue. The fact that women work as part of a household wage strategy is as true today as it was in the 19th century. The coexistence of wage and non-wage work within the household ensures the reproduction of labor power. Patriarchal organization in the family is carried into the workplace through management practices of labor control. Women's position in the family, at the workplace, and in society is jointly determined by traditional social norms and the requirements for capital accumulation.

The centrality of the household in labor reproduction is reflective of the strategy for capital accumulation. Other elements of that strategy include near-subsistence wages and company welfare services. Women's secondary status in the labor market allows TNCs to pay low wages while competing for women's labor not on the basis of wages but on a wide variety of "benefits" (Lim 1983). These "benefits," however, are provided largely at a level necessary to maintain productivity levels, although any social welfare program also serves the purpose of legitimation. These services are also an important part of the labor process; they are an arena where labor-management struggles take place, even though often at an individual level. Hence, conditions for reproduction and production are closely intertwined.

That companies provide welfare services, however, is also indicative of the level of consumption in society, that is, the lack of public investment in social infrastructure. (In this respect, it is not surprising that companies in Singapore provide fewer services than those in Malaysia, as the investment in public infrastructure is greater in Singapore). So, while the state makes possible an economic environment for foreign investment which includes industrial peace, the companies themselves still have to provide the infrastructure necessary to allow exploitation of human resources.

Labor control and compliance is created not only through low-wage strategy and limited public investment in social welfare, but also through a combination of simple and technical controls within the firm and of the operation of internal labor markets (Edwards 1979; Marglin 1982). Supervisors exercising arbitrary power are an extension of traditional practices in small family firms. At the same time, machines which are introduced dictate the pace of work. The internal labor market, in conjunction with the external labor market, reduces mobility between firms. A sense of collectivity among workers is minimized within the industry. For unskilled workers, mobility becomes, in fact, even more limited. Chances of promotion are slim, while at the same time seniority (and economic needs) prevent workers from changing jobs.

Insofar as women workers lack the resources and opportunities to pursue careers, their world view becomes an important coping mechanism (Sabel

1982). Being unskilled and female, women workers are more concerned initially about the economic rewards of the job, since most work out of necessity. As they become integrated into the workplace, however, their world view is transformed by the work experience. While they still seek satisfaction in activities outside of work, interpersonal relationships at the workplace become increasingly important in their lives. Thus, participation in industrial work can change not only the economic standing of workers but also their ideologies (Saffioti 1983).

Yet, as a new working class is being made from large numbers of women, social attitudes and social structures do change. While women's occupational mobility may be as restricted as their social class standing, work can change their standing within the family, and the instrinsic rewards of work can change their outlooks.

The lives and perceptions of women electronics workers in the present study reflect these various forces and trends. The women have taken jobs with low wages, long hours, and health hazards in order to contribute to the economic well-being of their families. On the job, not only are promotions and new skills rare, but also women are retrenched with economic downturns and introductions of new technology. At home, women continue to bear the burden of household chores.

Yet, with an initial "careerless" outlook and a low-mobility working environment, many have developed job aspirations and self-esteem. The social nature of the jobs has contributed significantly to the new outlook. The financial rewards reinforce the status of being socially productive. Out of the new understanding of the working world comes a new consciousness, however rudimentary, of being a woman and a worker. Women's coping methods -- including an emphasis on social relations at work rather than on job tasks -- seem to strengthen group solidarity.

Thus, despite the multiple manners through which the subordination of women is structurally sustained, women workers manage to find strengths within themselves and among each other to fight back. Worker resistance is manifested not only through individual sabotage and labor withdrawal but also through mass hysteria. In bringing about capitalist development and proletarianization of women, the new international division of labor has unleashed a process of social change that will be difficult to bring under control. The long-term social consequences of economic development are likely to be more extensive than government planners ever anticipated. The experiences of these women also foreshadow what is to come for women in many other less developed countries. Their current situation is no mere aberration.

NOTES

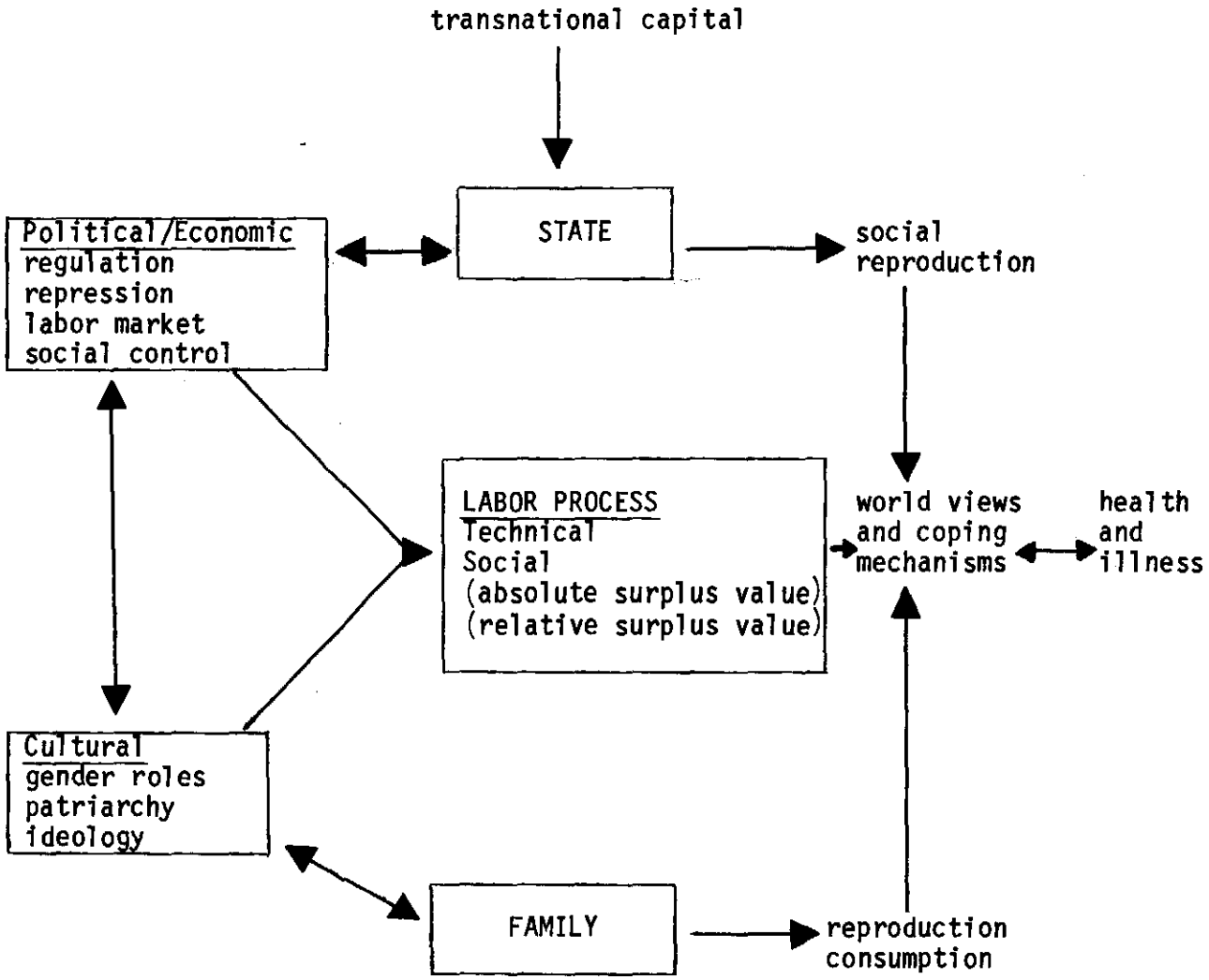
1. The survey respondents can be divided into two general job categories: (1) production -- the basic tasks in assembly, end-of-line and test operations, plus the promotional positions in the production areas -- and (2) clerk -- paper work, whether associated with administration or production. The sample from Singapore consists of 432 production workers and 86 clerical workers, while the sample for Malaysia is made up of 341 production workers and 44 clerical workers. The production workers can be further categorized into several work areas. These are (1) assembly, (2) end-of-line, (3) test, (4) unattached QC (those who perform quality control duties but who are not attached to a specific production area), and (5) leaders (the promotional positions of lines leader, material handler, trainer, etc., who do not work in a specific production area).

2. "Bumiputra" ("Bumi" for short) refers to Malays and other indigenous peoples. Literally, it means "son of the earth."

3. In 1983, the exchange rates were approximately US$1=S$2.15 and US$1=M$2.25.

4. In April 1983, workers making finished products -- as opposed to components -- were permitted to join unions.

Figure 1
The Political Economy of Health



Note: The arrows show the directions of influence.

Table 1
Hourly Wages for Operatives in Selected Countries, 1974 (US$)

	Unskilled	Semi-skilled
Hong Kong	.43	.61
Malaysia	.17	.21
Philippines	.15	.21
Singapore	.38	.41
Taiwan (women)	.23	.25
Indonesia	.23	.34
Thailand	.15	.31

Sources: Froebel et al. 1980; Hancock 1980.

Table 2
Hourly Wages in Electronics in Selected Countries (US$)

	1976	1980	1985
Hong Kong	.55	.97	1.60
Malaysia	.42	.42	.75
Philippines	.32	.32	.39
Singapore	.62	.90	2.43
Taiwan	.37	.90	1.70
Indonesia	.17	.45	-
South Korea	.52	.91	1.36
United States	-	6.96	12.59
Japan	-	5.97	6.35

Sources: Edgren 1982; Global Electronics Newsletter No. 21 and No. 60.

Table 3
Size of Industry (all branches)

Selected Countries		Number of Workers or Factories
Hong Kong	1981	89,485 workers
Singapore	1980	65,930 workers
Taiwan	1975	28,813 workers
Malaysia	1979	42 factories
Philippines	1980	14 factories
South Korea (Masan Free Trade Zone)	1975	26 factories

Sources: Froebel et al. 1980; Singapore Yearbook of Statistics; Hong Kong Ministry of Labour Annual Report; Eisold 1982.

Table 4
Percentage of Women Employed

Selected Countries		Manufacturing	Electronics
Hong Kong	1981	50%	60%
Malaysia	1979	39%	85%
Philippines	1979	47%	90%
Singapore	1980	46%	75%

Sources: I.L.O. Yearbook of Statistics; Eisold 1982.

Table 5
Summary of Literature: Sociodemographic Data

Variables	Country	Source	Data
Age	Singapore	Chia (S.Y.)	*95% in electronics below 40
		Lin 1984	*Average age of 22 in one TV assembly plant
	Thailand	Blake and Moonstan	*Average age of 19 in the largest electronics company
	Philippines	Castro	*88% of production workers in BEPZ (Bataan Export Processing Zone) under 29
		Snow	*50% of sample between 18 and 22
	Malaysia	Datta/ Chaudhuri	*Average age of 21.7 for women working in EPZ
		Chia	*Average age of 19 among survey respondents
	Taiwan	Arrigo	*40% of women workers between 16 and 19; 31% between 20 and 24
	South Korea	Maex	*85% of workers in Masan Free Trade Zone between 18 and 30
Marital Status	Singapore	Lin 1984	*85% of survey respondents single
	Thailand	Blake and Moonstan	*85% of production workers unmarried
	Philippines	Castro	*83% single
	Malaysia	Datta/ Chaudhuri	*70% single
	Taiwan	Arrigo	*60% of female labor force single
Work Experience	Singapore	Lin 1984	*44% of respondents previously employed as factory workers, cashiers, clerks, and housekeepers
	Malaysia	Datta/ Chaudhuri	*52% of female workers with no previous employment
		Woon	*72% of sample with no previous work experience; 22% previously employed as factory workers
	Philippines	Castro	*64% at BEPZ new to labor market; those previously employed were factory workers, tailors, and in service sector
		Snow	*84% of respondents with no factory experience

Table 5
Summary of Literature: Sociodemographic Data (continued)

Education	Singapore	Lin 1984	*Average 9.5 years of education in one company
	Philippines	Castro	*60% in BEPZ high school graduates
Place of Origin	Malaysia	Urban Services Study Chia (K.C.)	*45% of FTZ workers in Penang migrants
	Philippines	Castro	*62% of BEPZ workers recent migrants

Table 6
How many minutes does a woman have to work to buy . . .

	1 egg	1 kg. rice	1 coke	1 t-shirt
Japan	2	37	8	199
Taiwan	5	44	23	174
Hong Kong	5	55	11	200
South Korea	7	199	37	312
Thailand	10	55	23	686
Malaysia	14	75	45	897
Philippines	20	70	27	611

Source: as quoted by Frentes and Ehrenreich 1983.

Table 7
Monthly Wages and Expenses of the Electronics Worker 1978 (US$)

	Starting wage	After 2 years	Expenses
Hong Kong	136	187	123
Indonesia	19	29	26
Malaysia	57	100	45
Philippines	40	75	37

Source: Grossman 1978.

Table 8
Summary of Literature: Working Conditions

Variable	Country	Source	Data
Health	Thailand	Blake and Moonstan	*Eye complaints by 1/3 of workers interviewed
	Malaysia	Grossman	*1/2 of workers complained about deteriorating eyesight and frequent headaches after 3 years of microscope work
		Woon	*34% of interviews related headaches and deteriorating eyesight
	Philippines	Labour Research Centre	*Complaints of headaches, eye strain, watery eyes, and blurred vision
	Korea	UNIDO	*88% had chronic conjunctivitis, 44% became nearsighted, and 19% developed a stigmatism after 1 year
		Lee	*63% eye problems, 48% skin disorders, 64% stomach problems in one company
	Hong Kong	Global Electronics Newsletter	*45% myopia, 13% bronchitis, and 43% backaches in one screening
			*90.2% of microscope workers had eye strain, 23.5% complained of double vision, 60.8% deteriorating eyesight; 35.5% frequent sore throat, 25% runny noses, 47.5% constant headaches, 38.8% frequent drowsiness, 31.7% dizziness, and 25% insomnia
Accident	Singapore	Lin 1984	*Electric shock frequent in TV assembly plant
	Malaysia	Global Electronics Newsletter	*Explosion due to leakage of Krypton-85
	Hong Kong	Asia Monitor Resource Centre	*Gassing incident where pregnant women exposed to zone and phosgene later miscarried
Mass Hysteria	Singapore	Chan et al.	*Observed among Malays
		Lim 1978b	*Common during graveyard shift
	Malaysia	Lim 1978b	*As above
		Ackerman	*Relates to lack of grievance procedures

Table 9
Summary of Literature: Conditions for Reproduction

Variable	Country	Source	Data
Housing	Singapore	Lin	*95% of respondents live with families in flats; average number of 3 occupants per room, 6 residents per flat
	Philippines	Snow	*46% of respondents live in boarding houses; extensive squatting
	Malaysia	Chia (K.C.)	*80% respondents live in rooms of 6
		Jamilah	*Prefer to live with friends, as only 9% of respondents live in company hostel
Food	Thailand	Blake and Moonstan	*Second largest expenditure next to family support
	Philippines	Snow	*64% of pay goes to room and board
	Malaysia	Malaysia SERU	*Vitamin deficiency and anemia prevalent among industrial workers
		Blake	*Workers' meal intake irregular and unbalanced
Health Care	Hong Kong	Eisold	*88% of factories with no medical facilities; only 11% with doctor or nurse to visit factory
Recreation	Singapore	Lin	*Housework, shopping, and sleeping most common spare-time activities
	Philippines	Eisold	*Workers drift into prostitution when retrenched
	Malaysia	Lim (K.C.)	*Visit friends; shopping and movies common spare-time activities
Childcare	Malaysia	Lim (L.L.)	*Some send children back to the village

Table 10
Characteristics of the Companies

	S1	S2	M1	M2	M3
Nation of origin	US	US-EEC	US	Japan	US
Date of operation	1968	1968	1972	1973	1973
Size	2300	3000	3800	2100	3000
Labor turnover	1-3%/month	4-6%/month	1-3%/month	4-6%/month	1-3%/month
Operational days	6 days/week	5 days/week	6 days/week	6 days/week	6 days/week
Shift rotation	biweekly, 3 shifts	biweekly, 2 shifts permanent graveyard	biweekly, 3 shifts	weekly, 3 shifts	weekly, 3 shifts
Basis of pay	daily (S$250/month)	monthly (S$250/month)	daily (M$6.60/day)	daily (M$6.60/day)	monthly (M$200/month)
Merit increments	semi-annual	semi-annual	annual	annual	annual
Subsidies	food, limited bus, health care, hostel	health care	food, bus, health care, hostel	food, bus health care, hostel	food, bus health care
Clinic	1 nurse at all times; doctor twice/week for hour each	1 nurse at all times; doctor twice/day for hour each	1 nurse at all times; doctor 2 days/week for 1/2 day	1 nurse during office hours	1 nurse at all times
Pre-employment and period exams	both	both	both	both	both
Facilities	canteen, library	canteen	canteen, library, surau, shop	canteen, library, surau, shop	canteen, surau, shop
Activities	dinner, sports, beauty contest, classes	BEST, dinner, sports, OCC	dinner, sports, classes, talent show	sports, picnic	sports, picnic, dinner
Union	yes	yes	not allowed	not allowed	not allowed

Table 11
Number Injured Since Working

Country	Singapore[1]			Malaysia[2]		
Job Category	Clerical	Production	Total	Clerical	Production	Total
no injury	72 83.7%	294 68.0%	365 70.4%	41 93.1%	258 75.6%	299 77.6%
injury	14 16.3%	138 32.0%	153 29.6%	3 6.9%	83 24.4%	86 22.4%
TOTAL	86 100%	432 100%	518 100%	44 100%	341 100%	385 100%

1. Odds Ratio (OR)=2.41; x^2=8.0

2. OR=4.39; x^2=5.87

Table 12
Number Ill Within Previous 6 Months

Country	Singapore[1]			Malaysia[2]		
Job Category	Clerical	Production	Total	Clerical	Production	Total
no illness	54 62.7%	218 50.4%	272 52.5%	26 59.0%	159 46.6%	185 48.0%
illness	32 37.3%	218 49.5%	246 47.5%	18 41.0	182 53.4%	200 52.0%
TOTAL	86 100%	432 100%	518 100%	44 100%	341 100%	385 100%

1. OR=1.69; x^2=4.28

2. OR=1.65; x^2=1.96

Table 13
Eye Complaints and Experiences in Assembly Work

Country	Singapore[1]			Malaysia[2]		
Experience	No Assembly	Assembly	Total	No Assembly	Assembly	Total
no eye complaints	225 81.5%	132 55.5%	357 69.5%	110 80.3%	130 56.1%	240 65.1%
eye complaints	51 18.5%	106 44.5%	157 30.5%	27 19.7%	102 43.9%	129 34.9%
TOTAL	276 100%	238 100%	514 100%	137 100%	232 100%	369 100%

1. OR=3.54, x^2=66.25

2. OR=3.19; x^2=21.32

Table 14
Eye Glasses and Experience in Assembly Work

Country	Singapore[1]			Malaysia[2]		
Experience	No Assembly	Assembly	Total	No Assembly	Assembly	Total
no glasses	269 97.5%	197 82.8%	466 90.7%	133 97.1%	215 92.7%	348 94.3%
glasses	7 2.5%	41 7.2%	48 9.3%	4 2.9%	17 7.3%	21 5.7%
TOTAL	276 100%	238 100%	514 100%	137 100%	232 100%	369 100%

1. OR=7.99; x^2=30.81

2. OR=2.63; x^2=2.35

Table 15
Eye Complaints and Use of Microscopes

Country	Singapore[1]			Malaysia[2]		
Exposure	No micro-scope	Use micro-scope	Total	No micro-scope	Use micro-scope	Total
no eye problem	291 74.7%	50 42.1%	341 67%	170 71.1%	67 50.4%	237 63.8%
eye problem	99 25.3%	69 57.9%	168 33%	69 28.9%	66 49.6%	135 36.2%
TOTAL	390 100%	119 100%	509 100%	239 100%	133 100%	372 100%

1. OR=4.06, x^2=37.67

2. OR=2.43; x^2=15.3

Table 16
Musculoskeletal Complaints and Physical Strain

Country	Singapore[1]			Malaysia[2]		
Exposure	No physical strain	Physical strain	Total	No physical strain	Physical strain	Total
no M/S problem	96 91.4%	262 64.2%	358 69.8%	7 74%	170 59.6%	244 63.4%
M/S problem	9 8.6%	146 35.8%	155 30.2%	26 26%	115 40.4%	141 36.6%
TOTAL	105 100%	408 100%	513 100%	100 100%	285 100%	385 100%

1. OR=5.9; x^2=27.79

2. OR=1.93; x2=6.03

Table 17
Skin Problems and Exposure to Chemicals

Country	Singapore[1]			Malaysia[2]		
Exposure	None	Chemical	Total	None	Chemical	Total
no skin problems	170 70.6%	94 44.1%	264 63.6%	106 70.7%	78 62.9%	184 67.2%
skin problems	71 29.4%	80 45.9%	134 39.4%	44 29.3%	46 37.1%	90 32.6%
TOTAL	241 100%	174 100%	415 100%	150 100%	124 100%	274 100%

1. OR=2.04, x^2=12.47

2. OR=1.42; x^2=1.41

Table 18
Nose and Throat Problems and Exposure to Chemicals

Country	Singapore[1]			Malaysia[2]		
Exposure	None	Chemical	Total	None	Chemical	Total
no nose/ throat problems	200 83.0%	118 67.9%	318 76.6%	112 74.7%	74 65.5%	186 70.7%
nose/ throat problems	41 17.0%	56 32.1%	97 23.4%	38 25.3%	39 34.5%	77 29.3%
TOTAL	241 100%	174 100%	415 100%	150 100%	113 100%	263 100%

1. OR=2.32; x^2=12.1

2. OR=1.55; x^2=2.2

Table 19
Respiratory Problems and Exposure to Chemicals

Country	Singapore[1]			Malaysia[2]		
Exposure	None	Chemical	Total	None	Chemical	Total
no respiratory problems	210 87.2%	136 98.2%	246 83.4%	129 86%	89 78.7%	220 83.6%
respiratory problems	31 12.8%	38 21.8%	69 16.6%	21 14%	24 21.2%	45 16.4%
TOTAL	241 100%	174 100%	415 100%	150 100%	113 100%	263 100%

1. OR=1.89, x^2=5.25

2. OR=1.66; x^2=1.88

Table 20
Central Nervous System Problems and Exposure to Chemicals

Country	Singapore[1]			Malaysia[2]		
Exposure	None	Chemical	Total	None	Chemical	Total
no CNS problems	166 68.9%	85 54.2%	251 63.1%	90 60%	51 45%	141 53.6%
CNS problems	75 31.1%	72 45.8%	147 36.8%	60 40.0%	62 54.8%	122 46.4%
TOTAL	241 100%	157 100%	398 100%	150 100%	113 100%	263 100%

1. OR=2.32; x^2=8.21

2. OR=1.82; x^2=5.17

Table 21
Menstrual Complaints and Exposure to Solvents

Country	Singapore[1]			Malaysia[2]		
Exposure	None	Solvents	Total	None	Solvents	Total
no menstrual problems	185 80.5%	80 62.9%	265 74.2%	113 76.9%	61 67.7%	174 73.4%
menstrual problems	45 19.5%	47 37.1%	92 25.8%	34 23.1%	29 32.3%	63 26.6%
TOTAL	230 100%	127 100%	357 100%	147 100%	90 100%	348 100%

1. OR=2.42, x^2=12.15

2. OR=1.58; x^2=1.92

Table 22
Pregnancy Problems and Exposure to Solvents

Country	Singapore[1]			Malaysia[2]		
Exposure	None	Solvents	Total	None	Solvents	Total
no pregnancy problems	90 82.8%	35 72.9%	125 79.1%	38 88.4%	20 74.1%	58 82.8%
pregnancy problems	20 17.2%	13 27.1%	33 20.9%	5 11.6%	7 19%	12 17.2%
TOTAL	116 100%	48 100%	158 100%	43 100%	27 100%	91 100%

1. OR=2.7; x^2=1.06

2. OR=2.66; x^2=9.54

Table 23
Problems with Offspring and Exposure to Solvents

Country	Singapore[1]			Malaysia[2]		
Exposure	None	Solvents	Total	None	Solvents	Total
no offspring problems	109 94%	40 83.3%	149 90.8%	39 90.7%	23 85.2%	62 88.6%
problems with offspring	7 6%	8 16.7%	15 9.2%	4 9.3%	4 14.8%	8 11.4%
TOTAL	116 100%	48 100%	164 100%	43 100%	27 100%	91 100%

1. OR=3.77, x^2=0.70

2. OR=1.69; x^2=0.1

Table 24
Shiftwork and Sleeping Problems

Country	Singapore[1]				Malaysia[2]		
Shift	No Rotation	Rotation	Grave yard	Total	No Rotation	Rotation	Total
no sleeping problems	47 88.7%	338 79.7%	31 88.6%	417 82.5%	33 88.4%	267 74.1%	290 82.8%
sleeping problems	6 11.3%	86 21.3%	4 11.4%	89 17.5%	2 5.7%	79 23.5%	81 21.8%
TOTAL	53 100%	424 100%	35 100%	506 100%	35 100%	336 100%	371 100%

1. OR=1.98; x^2=7.62

2. OR=5.06; x^2=5.25

Table 25
Time Pressure and Psychological Complaints

Country	Singapore[1]			Malaysia[2]		
Time Pressure	Yes	No	Total	Yes	No	Total
no psychological complaints	135 45.2%	112 54.2%	2477 48.9%	61 36.8%	105 49.3%	166 43.8%
psychological complaints	164 54.8%	95 45.8%	259 51.1%	105 63.2%	108 50.7%	213 56.2%
TOTAL	299 100%	207 100%	506 100%	166 100%	213 100%	379 100%

1. OR=1.43, x^2=3.64

2. OR=1.67; x^2=5.47

Table 26
Time Pressure and Illness

Country	Singapore[1]			Malaysia[2]		
Time Pressure	Yes	No	Total	Yes	No	Total
no illness	134 45.3%	124 60.5%	258 51.5%	71 44.7%	114 52.8%	185 50.7%
illness	162 54.7%	81 39.5%	243 48.5%	88 55.3%	102 47.2%	190 49.3%
TOTAL	296 100%	205 100%	501 100%	159 100%	216 100%	385 100%

1. OR=1.85; x^2=10.6

2. OR=1.39; x^2=2.82

Table 27
Migration and Psychological Complaints

Country	Singapore[1]			Malaysia[2]		
Place of Birth	Local	Migrant	Total	Local	Migrant	Total
no psychological complaints	220 50.3%	25 38.5%	255 50.7%	111 47.7%	55 38.2%	166 44.1%
psychological complaints	218 49.7%	40 61.5%	248 49.3%	122 52.3%	89 61.8%	211 55.9%
TOTAL	438 100%	65 100%	503 100%	233 100%	144 100%	377 100%

1. OR=1.6, x^2=2.68

2. OR=2.88; x^2=2.88

Table 28
Migration and Sleeping Problems

Country	Singapore[1]			Malaysia[2]		
Place of Birth	Local	Migrant	Total	Local	Migrant	Total
no sleeping problems	309 82.2%	46 70.8%	355 80.5%	191 83.1%	109 77.4%	300 80.9%
sleeping problems	67 17.8%	19 29.2%	86 19.5%	39 16.9%	32 22.6%	71 19.1%
TOTAL	376 100%	65 100%	441 100%	230 100%	141 100%	371 100%

1. OR=1.9; x^2=3.93

2. OR=1.44; x^2=1.51

Table 29
Illness among Production Workers by Ethnicity

Country	Singapore[1]				Malaysia[2]			
Ethnicity	Chinese	Malay	Indian	Total	Chinese	Malay	Indian	Total
no illness	99 57.9%	73 43.7%	39 47%	211 50.1%	64 57.1%	64 40.8%	29 42.6%	157 46.6%
illness	72 42.1%	94 56.3%	44 53%	210 49.9%	48 42.9%	93 59.2%	39 57.4%	180 53.4%
TOTAL	171 100%	167 100%	83 100%	421 100%	112 100%	157 100%	68 100%	337 100%

Table 30
Symptomatic Complaints among Production Workers by Ethnicity

Country	Singapore[1]				Malaysia[2]			
Ethnicity	Chinese	Malay	Indian	Total	Chinese	Malay	Indian	Total
no symptomatic complaints	51 29.8%	37 22.2%	18 21.7%	106 25.2%	32 28.6%	37 24.6%	16 23.5%	85 25.2%
symptomatic complaints	120 70.2%	130 77.8%	65 78.3%	315 74.8%	80 71.4%	120 76.4%	52 76.5%	252 74.8%
TOTAL	171 100%	167 100%	83 100%	421 100%	112 100%	157 100%	68 100%	337 100%

Table 31
Marital Status and Sick Leave

Country	Singapore[1]			Malaysia[2]		
Marital Status	Single	Married	Total	Single	Married	Total
no sick leave	198 91.6%	151 80.4%	349 86.4%	192 82.5%	56 75.7%	248 80.8%
off sick	18 8.4%	37 19.6%	55 13.6%	41 17.5%	18 24.3%	59 19.2%
TOTAL	216 100%	188 100%	404 100%	233 100%	74 100%	307 100%

1. OR=3.54, x^2=66.25

2. OR=3.19; x^2=21.32

Table 32
Marital Status and Health Visits

Country	Singapore[1]			Malaysia[2]		
Marital Status	Single	Married	Total	Single	Married	Total
no health visit	156 58.5%	101 44.9%	257 52.3%	133 50.4%	32 40.6%	165 48.2%
health visit	111 41.5%	124 55.1%	235 47.7%	131 49.6%	47 59.4%	178 51.8%
TOTAL	267 100%	225 100%	492 100%	264 100%	79 100%	343 100%

1. OR=1.73; x^2=8.5

2. OR=2.49; x^2=1.97

Table 33
Marital Status and Spare Time Activities

Country	Singapore[1]			Malaysia[2]		
Marital Status	Single	Married	Total	Single	Married	Total
housework	135 48.3%	148 70.1%	283 60.2%	145 52.2%	56 59.6%	201 54%
rest and recreation	58 22.4%	15 7.1%	73 15.5%	52 18.7%	16 17%	68 18.3%
solo activities	66 29.3%	48 22.8%	114 24.3%	81 29.1%	22 23.4%	103 27.7%
TOTAL	225 100%	211 100%	470 100%	278 100%	94 100%	372 100%

Table 34
Ethnicity and Spare-Time Activities

Country	Singapore[1]				Malaysia[2]			
Ethnicity	Chinese	Malay	Indian	Total	Chinese	Malay	Indian	Total
housework	115 51.6%	109 64.9%	62 71.3%	286 59.8%	64 42.1%	93 56.4%	48 64.8%	205 52.4%
rest and recreation	48 21.5%	17 10.1%	8 9.2%	63 13.2%	58 38.1%	14 8.5%	9 12.2%	81 20.7%
solo activities	60 26.9%	42 25%	17 19.5%	119 27%	30 19.8%	58 35.1%	17 23%	105 26.9%
TOTAL	223 100%	168 100%	87 100%	478 100%	152 100%	165 100%	74 100%	391 100%

Table 35
Shift Rotation and Meal Intake

Country	Singapore[1]				Malaysia[2]		
Shift	No Rotation	Rotation	Grave-yard	Total	No Rotation	Rotation	Total
regular meals	39 75%	308 73.0%	22 62.9%	369 72.5%	31 86.2%	255 74.4%	286 75.5%
no regular meals	13 25%	114 27.0%	13 37.1%	140 27.5%	5 13.8%	88 25.6%	93 24.5%
TOTAL	52 100%	422 100%	35 100%	509 100%	36 100%	343 100%	379 100%

Table 36
Regularity of Meal Intake and Gastrointestinal Problems

Country	Singapore[1]			Malaysia[2]		
Meal	Regular	Not Regular	Total	Regular	Not Regular	Total
no G/I problems	309 84.7%	109 80.7%	418 83.6%	194 70.1%	46 56.8%	240 67.1%
G/I problems	56 15.3%	26 19.3%	82 16.4%	83 29.9%	35 43.2%	118 32.9%
TOTAL	365 100%	135 100%	500 100%	277 100%	81 100%	358 100%

1. OR=1.38; x^2=1.19

2. OR=1.78; x^2=4.39

Table 37
Gastrointestinal Problems and Source of Meal

Country	Singapore[1]			Malaysia[2]		
Source	Home	Factory or Hawkers	Total	Home	Factory or Hawkers	Total
no G/I problems	309 83.8%	90 77.6%	399 82.3%	179 72.2%	45 56.3%	224 68.4%
G/I problems	60 16.2%	26 22.4%	80 16.5%	69 27.8%	35 43.7%	104 31.6%
TOTAL	369 100%	116 100%	484 100%	248 100%	80 100%	328 100%

1. OR=1.48; x^2=1.89

2. OR=2.02; x^2=6.39

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