EDITORIAL REVIEW

Rosie the Riveter's Wartime Medical Records

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Abstract

On October 24, 2000, the Rosie the Riveter World War II/Home Front National Historical Park was established in Richmond, CA to commemorate in a substantial way the wartime women workers in the shipyards. A review of the 1942-1945 published case reports from the medical records of women who worked in the Kaiser Shipyards in Richmond, found that the women who helped build ships for the war effort suffered many of the same medical problems as the men with whom they worked.

On December 7, 1941, the largest single military attack on American soil devastated the Pacific Fleet. Only one month later, Henry Kaiser's Shipyards in Richmond, CA employed 30,000 men and women in perhaps the largest mixed-gender industrial workforce ever assembled. These men and women worked side-by-side in a variety of trades, using newly developed techniques and heavy machinery to rebuild and bolster the US Navy. These workers risked severe injury in an environment that aggravated any predisposition to respiratory illnesses; particularly for the men in this workforce, most of whom were not accepted into the armed forces because of age and/or compromised physical conditions.

Garfield,[1] who provided all the medical services, industrial and nonindustrial, to the Kaiser Shipyard workers, wrote that, from December 1941 to October 1943, 48,330 casualties, injuries, and deaths in the American armed services were reported. The National Safety Council of Chicago reported that during this same period there were more than seven million casualties among the workers in industry in the US.[1] In a survey of the war production industries, Hanna[2] found that shipbuilding had the highest rates of disabling injuries of all war production industries. Kossoris[3,4] reported that in nearly every department studied women experienced relatively more disabling injuries than men. In welding and burning operations, the frequency rate of injuries in women was 64.6% compared with 41.3% for men. McElroy and McCormack[5] noted that, in 1943, there were 31.2 disabling injuries for each one million employee hours worked in federal contract shipyards. Lane[6] reported that for every 100 shipyard employees, there were 7.3 injuries in 1943, 5.5 in 1944, and 4.9 in 1945; and attributed the declining injury rate to the implementation of safety rules by the US Maritime Commission.[7] A significant percentage of the male workforce were either over draft age or in poor health; the majority of younger men had been classified 4F (unfit for service) by their local draft boards. Smillie,[8] an early Permanente physician, wrote that the first workers were recruited without regard to age, gender, or physical condition. They arrived in Richmond by trainload from different parts of the country and were quartered in quickly erected barracks; later, when families arrived, they lived in government-financed housing.

In the Richmond Kaiser Shipyards, pre-employment physical examinations were not allowed under the union contract. Had physical examinations been permitted, nearly all of these workers would have been employed because of the severe shortage of civilian manpower. Age limits were of no consideration for the duration of the war. Kuh,[9] a physician working at the shipyards and trained in public health, introduced a selective placement process identified as *Physical Demands and Capacities Analysis,* wherein a set of physical and environmental factors served as the patterns to be used by a job analyst to describe the job requirements and to be used by a physician to evaluate each worker to facilitate the placement officer's task of matching worker and job. Kuh[10] reported that many women welders left the shipyards because they were physically unable to do the work. He described how one of the gynecologists working at the shipyards developed a physical training course to prepare women for the strenuous work: a scaffolding was erected outside of the welding school and women were taught to climb high ladders, to lift heavy loads, and to climb with loads.[11]



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In 1943, three fifths of all women shipyard workers in the US were employed by Pacific coast private shipbuilders in the US.[12] Eventually one-third of the 90,000 Richmond shipyard workforce were women; 60% of workers at another shipyard were women. In these shipyards, tons of steel were cut, shaped, welded, riveted, and swung into place by cranes on a daily basis. Women did the same work done by men and were exposed to the same occupational and environmental health hazards. Thus women suffered from some of the same medical problems. By the end of the war in 1945, the Richmond Kaiser Shipyards had built more than 1000 Liberty and Victory-class freighter and cargo ships. Steve Gilford (personal communication, 2004)[a,b] wrote that building a Liberty ship required about 150,000 rivets. On June 8, 1943, a riveter named Rose "Rosie" Bonavita set a production record by driving 3345 rivets in one work shift while working on a bomber aircraft. For this astonishing feat she was dubbed "Rosie the Riveter" by the press and she received a personal letter of commendation from President Franklin D Roosevelt. The extraordinary ability of some women who worked in the shipyards to become very efficient riveters had already been recognized when an image of Rosie the Riveter, painted by Norman Rockwell, appeared on the cover of the *Saturday Evening Post* magazine on May 29, 1943.[13] She came to symbolize the women who worked in war industries at jobs that had not previously been expected of them (Steve Gilford, personal communication, 2007).[c] To honor these Rosies in particular, a Congressional Act, signed by President William Clinton on October 24, 2000,[14] established the "Rosie the Riveter World War II/Home Front National Historical Park" on the site of the former Richmond Kaiser Shipyards.

In March 1942, Sidney Garfield, MD, and his small group of six medically deferred physicians and six nurses, began to provide care to the shipyard workers in first-aid stations located in shipyards 1 and 3. In June 1942, with a total of nine doctors and eight nurses, they opened the first aid station in shipyard 2. Dr Garfield then purchased and rebuilt an old hospital in Oakland, CA that opened with 80 beds. On August 1, 1942, it was dedicated by Henry Kaiser as the Permanente Foundation Hospital. This hospital was then staffed with 13 doctors, 25 nurses, and 32 other personnel. On August 10, 1942, the Richmond Field Hospital was opened with 10 beds. By February 1943, the total number of beds in both the Oakland and Richmond hospitals was 209 and the total staff included 62 doctors, 241 nurses, and 324 other personnel, serving a total of 90,600 workers. In his "First Annual Report," Dr Garfield[1] wrote that, in 1943, the average number of patient visits-per-month to all three First Aid Stations was 97,473; and 5.8% of the patients had been referred to the Richmond Field Hospital for further treatment. Under Dr Garfield's leadership the enterprise grew to become the largest civilian medical care program on the Home Front.

Of 2984 major surgical procedures performed during 1943, 5.4% were in the gynecology service. The first 100 appendectomies, in 90 men and 10 women, were performed with no mortality.[15] Cecil Cutting, MD, (see "In Memoriam") the first Chief-of-Staff, reported that in the first 18 months, Permanente general surgeons performed 1001 major operations (excluding orthopedics, gynecology, and urology), including 471 hernioplasties, 297 appendectomies (50 patients had ruptured appendices); all done without a single surgical fatality.[16] By October 1944, 427 appendectomies had been performed, with 55 of these patients having perforated appendicies, without any fatalities.[17]

In Dr Garfield's "Second Annual Report," he wrote that in 1944 the number of employees in the shipyards had decreased to 68,000 because many employees felt that the war was coming to an end and they returned to their homes.[18] Dr Garfield also reported that he had established the Permanente Foundation Health Plan in 1942, with its membership offered to the families of workers, and it had been subscribed to by 90% of the workers.[18]

During 1943, more than 23 million units of pneumococcus rabbit serum were dispensed from the hospital pharmacy.[18]

During the year 1944, the number of patient visits to the First Aid Stations had decreased to 77,989; of which 5.1% of patients had been referred to the Richmond Field Hospital (now 100 beds) or to the Oakland Hospital (300 beds). There were a total of 10,337 patients discharged from both hospitals in 1944, including some family members of shipyard workers. A total of 705 women were discharged from the gynecology service; 267 gynecologic surgical procedures had been performed; 224 women had been discharged from the obstetrics service; and there had been 151 newborns.[18]

In Dr Garfield's published review of Permanente's first ten years, he reported that in the spring of 1945 the Richmond shipyards began to close; and the number of Richmond workers rapidly decreased to 13,000.[19] The physician group then decreased from 75 to about a dozen physicians. This was the nascence of The Permanente Medical Group, which was officially formed in 1947.[8] The Permanente Foundation Health Plan, which in 1942 had served about 70,000 members, reached its lowest point of 14,500 members in October 1945.

Membership was then opened up to the community.[19] By May 1949, the Health Plan had grown to about 70,000 members; in April 1950, it had about 110,000 members[20]; and in 1952, 250,000 members.**[19]** The now-named Kaiser Foundation Health Plan membership, as of February 2008, is 8,698,874 members nationwide, (Won S Ha, personal communication, 2008)[d] fulfilling the vision of Dr Garfield and Henry Kaiser born in the Richmond shipyards during those war years.

The medical records of the shipyard workers during the war years (1941-1945) were the sources of articles published in the *Permanente Foundation Medical Journal,* from which the case reports and statistics included here were abstracted. These tell the medical story of the contribution to the war effort of the women shipyard workers who suffered from a variety of trauma, occupational diseases, and nonoccupational medical problems in service to their country.

Trauma Cases

From 1942 to 1944, 248,000 patients were seen in the Richmond and Oakland Permanente Hospitals. A total of 13,261 fractures were treated; most common were fractures of the hands, of the feet, and of the ribs.[21] During an 18-month period, 52 shipyard workers with fractures of the mandible—12 of which occurred in women—were treated at the two hospitals. More than half of the mandibular fractures were multiple; 44 of the patients were satisfactorily treated by wiring; 8 required external skeletal fixation—1 was a woman who fell 60 feet from the top deck of a hull; she also suffered a skull fracture.[22]

During this two-and-a-half-year period, 95 patients had nonpenetrating pulmonary injuries treated at the two hospitals; two of whom were women: one, age 20 years, was struck by a train and suffered compound fractures of both humeri, fractures of the left third and fourth ribs, and a puncture of the lower lobe of the left lung; she died six hours after admission to the hospital. The other, age 22 years, suffered a chest injury in an auto accident and sustained fractures of the right second to seventh ribs. Her chest x-ray showed consolidations in the upper and lower lobes of the right lung. After two weeks of treatment in the hospital her lungs became clear and she recovered without any complications.[23] An additional 56 patients with nonpenetrating chest injuries developed pneumonia following their injuries. They were treated in the hospital for post-traumatic pneumonia. One woman, aged 34 years, had been struck in the right side of her chest by a vehicle; she sustained fractures of the right fourth to sixth ribs, complicated by a right pneumothorax. After treatment with sulfadiazine, the drug of choice at the time, her recovery was uneventful. Another woman, aged 31 years, sustained fractures in the midaxillary region of the left eighth and ninth ribs following a fall in her home. She developed a right lower-lobe pneumococcic pneumonia that responded well to treatment.[24]

In 1943, four cases of acute fat embolism, an unusual complication of compound fractures, were reported. One woman, aged 21 years, was hospitalized with a diagnosis of acute fat embolism complicating the removal of bone fragments following a fracture of the tibia. Postoperatively she developed chills, fever, and pain in the chest. Her chest x-ray was normal, but her electrocardiogram showed typical changes of acute cor pulmonale, apparently caused by fat emboli to her lungs from the marrow of her fractured bone; her urine revealed the presence of fat. On the fourth day, the lipuria had cleared and all the acute symptoms had subsided.[25]

Other Occupational Cases

Like the men working in the shipyards, women suffered from a variety of occupational disorders. Stenosing tendovaginitis of the digital flexor tendons, commonly known as "trigger fingers," tended to occur in the third and fourth digits of the major hand in newly trained welders. As a result of the trauma of maintaining prolonged flexion, mild aseptic inflammatory changes developed at the proximal end of the tendon sheath, which eventually became thickened and constricted. A nodule would develop proximal to this constriction when the finger was maintained in this flexed position; the passage of the nodule through this thickening was responsible for the finger "locking." Thirty-eight patients with trigger fingers were seen; 24 were female welders. The majority were helped by splinting the proximal interphalangeal joint using short, padded, metal splints that relieved the locking of the finger while welding; only one patient required surgery to resect an elliptical area from the nodule.[26]

Welders were exposed to the fumes of vaporized copper and zinc. Most cases of metal fume fever occurred among welders working on galvanized metals. Metal fume fever was rarely severe enough to warrant hospitalization; yet during a four-year period 13 patients were admitted to the hospital with symptoms of chills, fever, headache, cough, nausea and vomiting. Most welders developed symptoms of metal fume fever on Mondays and they lost less than three days from work. The treatment was entirely symptomatic.[27]

From September 1942 to May 1944, 632 hernioplasty

procedures were performed; 574 (92.1%) were for inguinal hernias; 57.8% were judged by the California State Industrial Accident Commission to have arisen out of, or been aggravated by, work in the shipyards. Herniorrhaphies were performed on 483 patients, including 13 women.[28] Five hundred forty patients were treated by orthopedists for painful shoulders, 130 patients were treated for calcifications in the rotator cuff tendons; and one-half of all of these patients were women.[29]

Men and women suffered from the cold and dampness in the shipyards, located on the shores of the San Francisco Bay; respiratory illnesses, especially pneumonia, were very common. Of all 2176 patients with pneumonia treated in these shipyards during these war years; one-sixth were women. The fatality rate for women was one-half that of men—probably because the men were older or physically unfit.[30] During the eight-month period between September 1942 and May 1943, 517 patients with pneumonia were treated at the Oakland Hospital. Two-thirds of these cases were caused by pneumococci; 28% had pneumonia involving more than one lobe. The gross mortality rate for the 517 patients was 8.1%. At this time, sulfadiazine was the treatment of choice for coccic pneumonia; 12% of patients treated with sulfadiazine developed some form of sulfadiazine toxicity. The most common was crystalluria, which developed in 7.7% of patients—occasionally an obstruction of the ureter by the crystals required a urologist to flush them out.[31] Psychoses occurred in 0.8% of patients treated with sulfadiazine, and the mental symptoms cleared rapidly after discontinuing the drug.[32] In a series of 748 consecutive patients with pneumococcic pneumonia treated with sulfadiazine, 20.9% were very severely ill and received adjuvant, type-specific, pneumococcus rabbit serum; with a mortality rate of 6.2%. During 1943, more than 23 million units of pneumococcus rabbit serum were dispensed from the hospital pharmacy.[18] Between May 1, 1944 and February 1, 1945, 646 patients with pneumoccocic pneumonia were admitted to the Permanente Hospital in Oakland; all were treated with sulfadiazine, which was supplemented with injections of penicillin as it became available; with a mortality rate of only 1.1%. When penicillin became more plentiful, patients with coccic pneumonia were treated with parenteral penicillin alone.[33] In October 1945, 12 patients, 3 women, with moderately severe pneumococcic pneumonia were treated only with oral penicillin, 100,000 units every 2-3 hours. All responded promptly to this dosage schedule, with no toxic reactions or complications.[34]

Nonoccupational Medical Problems

Women shipyard workers also suffered from common gynecologic conditions. A cancer detection clinic was set up by the gynecologists. From July 1943 to July 1944, 20 women were seen with malignancies: 14 with different stages of cancer of the cervix, 3 with adenocarcinoma of the fundus of the uterus, 2 with cancer of the ovary, and 1 with an epidermoid carcinoma of the vulva.[35] Over a two-year period, cancer of the cervix was the diagnosis in 0.9% of all new patients admitted to the hospital gynecology service.[36] Two women had radical mastectomies for breast cancer. Henley[37] describes the case of a woman who received a blow to her left breast; after repeated self-examinations revealed that a small lump at the site had not disappeared, she came to the clinic where a biopsy revealed a carcinoma; a radical mastectomy was performed. One woman had an infiltrating epidermoid carcinoma of the posterior vaginal wall that required a one-stage, abdominal-perineal resection.[16] Two women with menstrual complaints were found on examination to have congenital transverse septa of the vagina, which were treated surgically.[38] The incidence of venereal disease during the war period was particularly high. Thirteen percent of all new gynecologic patients were found to be infected with gonorrhea, so a shipyard-wide educational program was initiated.[36]

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Twenty patients, five women, with duodenal ulcer all confirmed by upper-gastrointestinal roentgenograms, were treated.[39] Twenty-eight patients, four women, were found by upper-gastrointestinal roentgenograms to have gastroesophageal hiatus hernias.[40] Acute suppurative cholangitis was treated in three women workers who were admitted to the hospital with chills, fever, right-upper quadrant pain and tenderness, and a high white-cell blood count. All three were treated by surgical removal of the gall bladder; all recovered without any complications.[41] Three patients were treated for complete esophageal obstruction by meat as a foreign body. Wiesenfeld[42] describes the case of one of these patients, a woman, aged 23 years, who had swallowed lye as a child and had been treated in the past with a series of esophageal dilatations. While eating a steak, she began to complain of retrosternal pain and severe difficulty in swallowing, which progressed to complete aphagia. She was taken to surgery where, under local anesthesia, an esophagoscope was passed and the steak was removed using a grasping forceps.

Between March 1943 and January 1945, 20 adults, 4 women, were diagnosed with acute rheumatic fever. Their findings included a history of a sore throat from

one to four weeks prior to the onset of symptoms, temperatures over 100 degrees (F), migratory polyarthritis, changing heart murmurs, and transient electrocardiogram abnormalities. All had an elevated sedimentation rate, and 19 had a leukocytosis.[43]

Summary

With the dedication by the US National Park Service of the Rosie the Riveter World War II/Home Front National Historical Park on the site of the former Richmond Kaiser Shipyards, it is timely to commemorate some of the extraordinary contributions by women doing wartime work during 1942-1945 and to appreciate the serious hazards to which they were exposed and the great variety of medical problems they suffered. Fortunately, published case reports from their wartime medical records are available through archived copies of the first *Permanente Journal*: the *Permanente Foundation Medical Bulletin*. ❖

[a] Senior Consulting Historian, Kaiser Permanente Heritage Resources. Rosie the Riveter; On this date in history 2004;#307, Part 1.

[b] Senior Consulting Historian, Kaiser Permanente Heritage Resources. She gets a face; On this date in history 2004; #310, Part 4.

[c] Senior Consulting Historian, Kaiser Permanente Heritage Resources. There really was a first Rosie the Riveter. On this date in history 2007;#355, Part 6.

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In Memoriam
Cecil C Cutting, MD
October 31, 1910 – March 2, 2008

Cecil C Cutting, MD, a pioneer physician instrumental in establishing Kaiser Permanente and first and longest-serving Executive Director of The Permanente Medical Group (TPMG), died on March 2, 2008 at the age of 97 years. When Sidney Garfield, MD, and Henry Kaiser formed their alliance to provide prevention-oriented, prepaid health care for the workers at the Grand Coulee Dam in 1938, Dr Cutting was the first physician hired. The United States then formally entered World War II and the Kaiser Shipyards in Richmond, CA became the new home for Dr Cutting and of the innovative health care program. When the war ended in 1945, the program opened to the public. In 1948, Dr Cutting, with Dr Garfield and five other physicians, founded TPMG. Dr Cutting was selected Executive Director, a position he held for 20 years.

Dr Cutting graduated from Stanford University and received his MD from Stanford University Medical School. He completed his residency at Stanford Lane Hospital and San Francisco County Hospital in surgery and orthopedics. He served as Chief of Surgery and Chief of Staff at the Oakland and Richmond Medical Centers in California. In retirement, he was Medical Advisor to the Kaiser Foundation Research Institute. Dr Cutting is survived by his son Christopher, his daughter Sydney, named after Dr Garfield, and two grandsons.