mental tobacco smoke (2). This estimate falls close to the mid-point of the range published by Repace and Lowery, who state that between 500 and 5,000 lung cancer deaths may occur annually as a result of nonsmokers’ exposure to tobacco smoke (3). By comparison, figures published in the Journal of the Air Pollution Control Association estimate that between 1,300 and 1,700 total cases of cancer resulting from other air pollutants in the general environment occur each year in the United States (4). Thus, while the number of lung cancer deaths that may be related to ETS exposure is small compared with those caused by active smoking, the actual number of lung cancer deaths caused annually by involuntary smoking is large. In addition, ETS causes more cases of cancer annually than many other agents in the general environment that are regulated because of their potential to cause disease.

Further Resources

**BOOKS**


**PERIODICALS**


**WEBSITES**


**The Bill Schroeder Story**

**Memoirs**

By: Bill Schroeder Family and Martha Barnette

Date: 1987


About the Authors: Bill Schroeder’s children—Monica Bohnert, Melvin Schroeder, Stan Schroeder, Terry Schroeder, Cheryl Schroeder, and Rod Schroeder—and his wife, Margaret wrote *The Bill Schroeder Story* with the assistance of writer Martha Barnette. For many years, the family traveled both in the United States and abroad, following Bill in his Air Force career. All of the Schroeder children, along with their mother, were by Bill Schroeder’s side throughout the artificial heart transplant ordeal.

Martha Barnette (1957–) received her bachelor’s degree from Vassar College in 1981. Barnette worked as a reporter for the *Louisville Times* from 1981 to 1985. She covered Bill Schroeder’s artificial heart transplant for the *Washington Post*. She has been writing for national magazines since 1991 and, as of 2003, continued to work as a freelance writer.

**Introduction**

In the 1980s, many medical professionals looked to artificial heart transplantations and xenotransplantations (transplanting an organ from another species, such as baboons) to overcome a chronic shortage of donated human hearts. Artificial hearts, it was reasoned, would always be available, since they could be manufactured. Implantation of artificial hearts also eliminated or lessened the need for strong, and toxic, immune-suppressing drugs like cyclosporine, since theoretically they should not trigger an immune response.

One of the best known artificial hearts, the Jarvik-7, was invented by Robert K. Jarvik, an American doctor. The Jarvik-7 was made of plastic, aluminum, and Dacron polyester. It consisted of two pumps representing the human heart’s two ventricles. The Jarvik-7 was unable to obtain energy from the blood, so it needed an external power source to provide the pumping action. Two tubes connected to an air compressor pumped air in and out of the artificial heart. The tubes entered through the patient’s abdomen. Implantation of the Jarvik-7 required the patient to be connected to the pumping machines (a smaller portable pump and a larger stationary one) for the rest of their lives.

Bill Schroeder was one of six patients in the 1980s to receive the Jarvik-7 artificial heart. Each of the six faced enormous physical and emotional challenges, and all eventually suffered serious complications and died. Schroeder was diabetic and had smoked cigarettes for thirty years before quitting in 1982. His heart was starved for oxygen due to severely clogged coronary arteries. Starting in 1982, he had several heart attacks, each one slowly deteriorating more and more of his heart tissue. Medication and coronary bypass surgery in 1983 failed to stabilize his heart, and his cardiac doctor began to look for options. At first, he considered a human heart transplant, but eligibility guidelines for donated organs would
likely rule out the fifty-two-year-old diabetic. Another heart attack in October 1984 compelled the cardiologist to contact Dr. William DeVries, a controversial and world-famous heart surgeon who two years before had implanted the first artificial heart in Seattle dentist Barney Clark. A month later, on November 25, 1984, Dr. DeVries inserted the Jarvik-7 into Bill Schroeder’s chest.

Schroeder and his family were euphoric after he received his artificial heart. Two days later, when Dr. DeVries removed the respirator, Bill asked for a beer. The media would record virtually every moment of Bill’s experience. Nearly three weeks later, however, Bill began to suffer complications: strokes, seizures, depression, fever, and flulike illnesses. He received frequent blood
transfusions and a variety of drugs, including several experimental medications. Another series of strokes and ensuing lung complications finally ended his ordeal. In the end, Bill had died, but eerily the Jarvik-7 still pumped until Dr. DeVries and the Schroeder family turned it off in a symbolic gesture. The entire 620-day ordeal, the longest any one had ever survived with an artificial heart, had emotionally changed Bill Schroeder’s family in ways they could not anticipate.

Significance

The Jarvik heart was implanted into six patients in the 1980s. DeVries, who implanted five of them, hoped they would provide a permanent alternative to transplanting a human heart. However, severe complications from the procedure and the death of all artificial heart recipients raised many doubts about the viability of permanent artificial hearts. Since then, artificial hearts have mainly been used as a stop-gap measure to keep severely ill patients alive while they await a donated human heart.

From the 1980s until 2001, no one had performed a complete artificial heart transplant. To many, the loss of quality of life was too high a price to pay and the procedure was largely abandoned. But because of an ongoing shortage of human heart donors, many doctors still hope that artificial hearts will provide a cure for irreparable and devastating heart damage. A new artificial heart was developed and implanted into a patient in 2001. The AbioCor heart is a self-contained titanium and plastic pump made by a Massachusetts company. Since the AbioCor is self-contained, the risk of infection is greatly reduced. However, Robert Tools, the first person to receive the AbioCor, died of internal bleeding and organ failure after living with the device for 151 days.

The heart performs a rather simple mechanical function, but the living heart has proven to be tough to replace. The heart extracts fuel and nutrients from the blood and uses them to rebuild itself continuously. No one has yet devised a self-sustaining pump that can go for seventy years or more without any maintenance.

Primary Source

The Bill Schroeder Story [excerpt]

SYNOPSIS: These excerpts provide a glimpse of the emotions the family of Bill Schroeder experienced. The initial glee and hope when Bill was told he would be given an artificial heart turned into the harsh reality of severe physical complications, conflict from being in a medical experiment, and an emotionally depleted family. Finally, the family accepted that Bill was going to die and were grateful for the extra time they had with Bill.

His strength was seeping away with every hour. Margaret sat on the side of the bed, stroking his arm, just wishing she could give him a little bit of her own life. Her husband wasn’t saying anything, but she knew that even now, especially now, Bill Schroeder hated to be kept waiting. He’d been in this hospital almost two weeks, had let them run all kinds of tests—and the doctors still hadn’t said for sure that he could get that artificial heart.

The doctors back home had said that without a new heart, Bill would die in less than a month. His diabetes and age ruled out the possibility of a human heart transplant. He was down to the last resort. If the doctors here really were going to choose him for the artificial heart, it would have to be soon. If not . . .

The door opened, and Dr. William DeVries walked in, trailed by several members of his medical team. The tall, sandy-haired surgeon was smiling as they formed a half-circle around Bill’s bed.

“Well, Bill,” DeVries said, “we’ve decided to go for it. You’re now officially a candidate for the artificial heart.”

“Fine with me,” Bill said quickly. “When do we do it?”

First, DeVries explained, they’d have to read over and discuss a seven-page consent form, to make sure that Bill understood everything. DeVries would read it to him now and Bill would sign it. They’d go over the whole thing again, twenty-four hours later, then Bill would sign it again to show that he knew what he was doing. Margaret reached for Bill’s hand. The lanky surgeon sat down beside them and began reading aloud.

“ . . . I recognize that the ventricles—the larger two of the heart’s four pumping chambers—from my own natural heart will be removed . . .”

Margaret couldn’t believe it. It was like a dream. They really are going to give him the artificial heart.

“ . . . risks include: (a) emboli or blood clots which may lead to stroke, kidney loss, liver, bowel or lung dysfunction, or damage to other organs or body functions . . .”

She squeezed Bill’s hand. We made it. We really made it! Bill’s going to get himself that artificial heart.

“ . . . During his life with the Total Artificial Heart, Dr. Clark experienced kidney and lung problems, a pneumothorax, which is air in the lung cavity, valve breakage, seizures, bleeding complications, and
Bill didn’t say a word. He just watched DeVries and nodded every once in a while. After hanging on this long, he certainly wasn’t going to quit now.

“. . . No representations or guarantees have been made to me either that the procedure will be successful, or the length of time or the level at which the Total Artificial Heart will function . . .”

At least now we have a chance. I’m going to bring him home with me and we can be a family again.

“. . . I understand that the materials which are made public, as described in this paragraph, will protect my modesty and be within generally accepted bounds of good taste . . .”

Oh, come on, Dr. DeVries. You know we trust you. You just get Bill better.

“. . . I acknowledge by my signature to this special consent form that I have read and understand the foregoing, including the risks involved . . .”

Margaret thought he would never finish reading. Of course she wanted the doctors to save her husband. Bill was only fifty-two, with everything to live for—their grandbaby due in the spring, their third son’s wedding four months away, just the chance to come back home and live out whatever time he had left with his family. DeVries could read that thing backwards and sideways if he wanted to, as long as he gave Bill that artificial heart.

“Do you have any more questions?” DeVries asked. “Anything at all?”

“No,” Bill answered. “I understand everything.” He reached for the pen.

It was like an answer to prayer, the thought of Bill getting well again. He had really shown those doctors that he was their man: a positive attitude, a strong will to survive, cherished goals to live for, and a close family to support him until he got back on his feet.

Margaret couldn’t wait to tell the kids.

***

Although Bill showed little improvement, the Schroeders took some comfort at least in the knowledge that new strides were being made in heart implantation, thanks in part to Bill’s struggle. By the spring of 1986, there had been about two dozen implants of temporary artificial hearts, including not only the Jarvik heart, but others developed at Penn State, in Phoenix, Arizona, and in Berlin, West Germany. A twenty-five-year-old Arizona man who had received a human heart transplant in September after being kept alive for several days with a Jarvik heart—and who had suffered a mild transient stroke while on the device—was back at work as a supermarket manager. The Swedish man who had received a Jarvik heart, Leif Stenberg, had been well enough to hold a press conference in July. He’d spent his days in a Stockholm apartment, and returned to the hospital each night. But he suffered a severe stroke in September, gradually lost consciousness, slipped into a coma, and died in late November. Murray Haydon remained in the hospital, since he had respiratory problems and infections.

In early April the family’s regular meetings with DeVries began to take on a different tone. The doctor explained that a biopsy of Bill’s liver over the past several weeks showed that the infection was getting worse, and nothing could be done to reverse it. He warned them that Bill’s condition could only deteriorate.

The doctor showed the family some charts of the enzyme levels in Bill’s liver, a measure of how the organ was functioning. Normally, patients whose levels were in the hundreds would be very, very ill. Bill’s were slowly climbing above three thousand. Few people ever survived for long with such high enzyme levels, but again, Bill’s artificial heart didn’t suffer the damage which would be expected in patients with a normal heart. The focus of the Schroeders’ discussions with DeVries now shifted from getting Bill well to assuring the family members that the medical world was gaining unprecedented scientific knowledge from him, that he had confounded all the doctors’ predictions, and that he was still making history every day. What DeVries was saying was that they had to start preparing for Bill’s death. It was most likely that the liver infection would spread, and he would lapse into a coma and never come out of it. As time went on, the kidneys might fail, in which case the family would face the question of whether to put him on dialysis. Or his lungs might collapse, and they’d have to decide whether to put him on a respirator. Ultimately, if he were to lapse into a coma for a long time, they would have to decide whether to turn off the artificial heart and let him die.

It was difficult to imagine ever turning off the heart that Bill had wanted so badly, or ending the battle he had fought so hard. But the family unanimously agreed on one thing at this point: no more artificial measures.
At this point, the Schroeders also began to reflect on their own roles in the experiment. They recognized that they had entered the artificial heart program with very little understanding of what a medical experiment entailed. They knew that from the beginning they should have asked more questions. They definitely should have asked Bill what he wanted done in certain eventualities, such as being unable to talk or make decisions on his own or refuse certain tests. They should have discussed frankly how much each member of the family would be able to help out during and after Bill’s hospitalization.

If they’d had to do it over, they would have insisted that from the beginning that Bill have a small, consistent team of nurses to follow him throughout the experiment. They would have made sure that a lawyer went over the consent form to advise them of their legal rights and responsibilities. They would have quizzed their family doctors on every aspect of the complications listed in it. The consent form had clearly stated that having an artificial heart meant the risk of stroke, but it couldn’t list every implication—that, in turn, stroke might mean grueling, exhausting physical therapy, or, ultimately, a suctioning of his mouth and nose every few minutes. The family would also have tape-recorded more of their meetings with the medical team—something that might have made the doctors feel threatened, but that seemed the only way to be sure that everyone understood what was happening. It was too easy to get caught up in things and never really hear what the doctors had said.

They would have insisted that Bill and the family have regularly scheduled, inviolable private time together. And that, in turn, be informed it was impossible for the family to be with him all the time—that they should probably spend one day a week away from him, from day one and consistently throughout.

The family also began to understand the trade-offs involved in any medical experiment, whether clinical trials of a new painkilling drug or a new surgical device. Had they been asked to advise potential candidates for an artificial heart or any other experiment, they would have said:

You have to gamble on the possibility that the experiment might help you, but you also have to recognize that you will be part of a much larger project that may not save your life—that might even kill you—but could save the lives of thousands in the future. You have to accept the fact that, in a way, you will be donating your body to science while you are still alive. And you have to understand that your doctor will constantly struggle to walk a fine line between treating you and gathering data. You must understand and expect that mistakes will be made.

The Schroeders had thought all along that it was the artificial heart which was being tested. Now they realized that the experiment extended beyond the heart, the patient, the apartment—to the family itself. So many situations had come up that had never been faced before, and everyone, medical team and family alike, had had to make things up as they went along. And all of them had changed.

The whole family found themselves more serious than before, less certain that anything in life could ever come easily. The kids found that, in drawing closer to each other, they had lost touch with many of their friends. Their lives had become so unpredictable that they couldn’t be counted on to join their old pals for outings or parties, and much of their leisure time was taken up by regular trips to Louisville anyway. They found it hard to start a project at home, even something as simple as painting a fence or planning a gathering, because they never
knew if it would be interrupted. Many friends hesitated to bother them, uncertain whether to ask how their parents were doing. Sometimes the ordeal was the only thing the Schroeders wanted to talk about; sometimes they wished they didn’t have to talk about it at all. They often felt set apart from everyone else, as if they had moved away for a long time and no longer fit into their old circles.

The Schroeders also were struck by how much DeVries himself had changed. At the time of Bill’s operation, the surgeon had looked like a skinny young man barely out of college. Within a year much of his sandy hair had turned silver, and his boyish freckled face was deeply lined.

On some level Bill himself seemed to understand that he was still accomplishing something just by being alive, helping provide information that the doctors had never dreamed of obtaining. His medical chart now occupied more than eight feet of shelf space. When DeVries came to visit and tell him how much they were learning, Bill would listen and nod. In fact, he often seemed more alert than ever during this period. He’d play possum sometimes, but if someone exclaimed at something seen out the window, he’d snap awake and look, too. If the doctors turned their backs to discuss his medical condition, Margaret could see Bill was craning his neck to look around them and listen. The doctors told her that it was possible that he was more alert and perceptive now because the damage from the strokes was continuing to resolve itself. Every once in a while, though, it took him a minute to recognize people.

There was a lot of time to think during those long days at Bill’s bedside. Sometimes Margaret would get up to check the Utah console or look at the computer readouts, or just gaze in amazement at the machine that had become a part of her husband, that went wherever he went, and had never ceased its mechanical, life-giving rhythm. She would think back to her roots in the hilly farm country outside Jasper, remembering how her grandmother used to come into the cabin with her apron full of sassafras roots for tea to thin her blood in the summertime, or hang leeks and herbs from the ceiling to dry for medicines. If Margaret could observe so much change in her own lifetime, she wondered, what was going to happen by the time the grandkids were grown?

Sometimes when DeVries talked to Margaret now, she wouldn’t say a word to him. She was sure the doctor must think she was being angry or moody. That wasn’t the case at all—it was that he’d captured with his hands, and she couldn’t take her eyes off them. Those hands took out Bill’s heart and put in an artificial one and made him live again. Those hands gave me back my husband. Whatever their conflicts during the past, whatever the hardships and disappointments, and whatever was down the road, this fact remained: Those giant-sized hands had given Bill and the family some more time, moments that no one could ever take away. Just as nothing could change her gratitude toward Dr. DeVries, she also knew that she could never find the words to thank him enough. And sometimes she just couldn’t say anything at all to him.

Further Resources

**BOOKS**


**PERIODICALS**


**WEBSITES**