

Appendix A: Coverage of Antibiotic Resistance in the Popular Literature, 1950 to 1994

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The substance and tone of articles about antibiotic resistance in the popular literature have changed over time (Rosenkrantz, 1995).¹ In the 1950s sobering cautions about the dangers of antibiotic overuse accompanied announcements from medical and scientific experts celebrating reduced mortality from specific diseases. The articles were recast by the mid 1980s. The public was faced with new warnings that bacteria are “winning the race” because they are “smarter” than men. These conclusions are illuminated through the decade-by-decade analysis that follows.

■ 1950 to 1959

In the late 1940s and early 1950s scientific and popular periodicals were generally enthusiastic about the benefits that antibiotics would provide for human health and well-being through better medicine, agriculture, and even home gardening. Public interest can partly be gauged by the range of journals and articles. The *Saturday Evening Post*, as well as *Science*, published articles on streptomycin and tuberculosis; *Reader's Digest*

(June 1955) excerpted an article, “Bringing the Antibiotics Up To Date,” by Paul DeKruif, a popular science writer and author of *The Microbe Hunters*. But there were also many warnings against false confidence in the continuing usefulness of antibiotics.

Literature in this decade included feature articles about the problems of resistance. The *New York Times* (May 2, 1953) quoted Sir Alexander Fleming, who discounted reports that germs were becoming penicillin resistant and suggested that indiscriminate use led to patient sensitivity. Howard Florey, the English scientist who developed methods for producing penicillin, was quoted in *Newsweek* (Oct. 20, 1958) explaining that *Staphylococcus aureus* itself is not resistant; only certain strains that develop in hospitals produce an enzyme called penicillinase that destroys penicillin.

A reporter covering a U.S. Public Health Service conference on hospital infections wrote that “. . . every week in the year at least one hospital in the cleanest country on earth is threatened with an outbreak of serious ‘staph’ infections” (*Newsweek*, Sept. 29, 1958). In the same year,

¹ Rosenkrantz, B.G. 1995. Historical Review: Responses to Antibiotic Resistance. Contract Report to the Office of Technology Assessment. Photocopied transcript.

the U.S. Surgeon General announced that overreliance on antibiotics had led to inroads by the “golden staph” [*Staph. aureus*]. The public learned that these germs could be found everywhere. The recommended response for control was hospital hygiene and asepsis, not more antibiotics (*Time*, Mar. 24, 1958).

The popular press pondered the cause of this growing problem. Was it the unjustified or unscientific use of antibiotics, or were medical practitioners taking a “shotgun” approach to therapy? An unnamed surgeon reflected that in his field penicillin was used casually, “like water.” An article in *Science News Letter* (1953) was titled “Fear Man-made Epidemics.” Scientists were cited explaining that antibiotics should not be used prophylactically in attempts to ward off infection.

At the same time, scientists informed the public about research on the causes of bacterial resistance. *Time* (Mar. 24, 1958; Nov. 17, 1958) reported that microbiologists were divided about whether *Staphylococcus* develops resistance to antibiotics or whether antibiotics eliminate susceptible *Staphylococci*, leaving behind the most virulent strains. Although antibiotics might have falsely raised expectations, by the end of the decade most of the popular press did not question the authority of scientists or the capability of science and medicine to continue to make progress in fighting disease.

■ 1960 to 1969

During the 1960s new questions surfaced about the responsibility of government in ensuring the safety and efficacy of pharmaceuticals, and increasing concern about the dangers of bacterial resistance furthered public interest in the development of new antibiotics. In this decade the U.S. Food and Drug Administration (FDA) became more visible to the public; first through Senator Estes Kefauver’s hearings on the drug industry, but even more so when the tragedy of thalidomide was narrowly averted in the United States.

For the more informed reader, *Science* (May 26, 1967) explained how “R factors” (now called plasmids) mediated resistance, and *Newsweek* (Aug. 22, 1966) introduced scientific language to explain that “resistant bacteria can pass their R factors along to bacteria of other strains,” emphasizing the specific dangers posed by mutant *Escherichia coli* from cattle fed antibiotic-laced feed. Perhaps to appear evenhanded, the same article implied that an editorial in the *New England Journal of Medicine* warning about the dangers of indiscriminate antibiotic use might be overdramatic. *Good Housekeeping* (August 1961; January 1964) warned that antibiotics were never to be used casually for minor ailments. In the early 1960s, the *New York Times* published reports of a steady increase in antibiotic-resistant hospital infections (Mar. 12, 1961; Feb. 25, 1962; Sept. 28, 1962).

Despite the introduction of new antibiotics, and the promise of more yet to be identified, the popular press cautioned that specific criteria should be used to determine which drugs are effective in treating each disease. The science editor and editorial board of the *New York Times* (Sept. 9, 12, 14, 1966; Nov. 21, 23, 1969) produced a series on the transmission of antibiotic resistance among bacteria. Resistance was described as a widespread peril that could be spread by “mating” among different bacteria.

In 1967 the *New York Times* reported that, in comparison to Great Britain, the United States was slow to control use of antibiotics in agriculture, a lapse that could exacerbate resistance (*New York Times*, June 11, 1967). Newspapers covered the tensions in the debate among interested parties, including: recommendations generated by FDA and the National Research Council of the National Academy of Sciences regarding limiting antibiotics in animal feed; skepticism registered by pharmaceutical firms about the significance of antibiotic resistance; and warnings by the meat industry about potential price increases should antibiotic protection of herds be prohibited (*New York Times*, Sept. 22, 1966; June 11, 1967).

■ 1970 to 1979

In the 1970s the periodical press turned sympathetically to physicians for their perspectives on the conflicting benefits and dangers of antibiotics. *McCalls'* (October 1976) regular physician columnist Dr. William Nolen authored “Antibiotics: What They Will and Won’t Cure,” and focused on the therapeutic limitations of antibiotics, but he did not raise the complications of antibiotic resistance. Other periodicals focused on the fundamentals of bacterial genetics. *Newsweek* (June 19, 1978), in its regular coverage of medical news, directed attention to hospital “mini-epidemics” and the new medical specialty, infection control, that brought doctors, nurses, technicians and epidemiologists to the scene. Attention to antibiotic resistance was also more frequent in articles on agriculture, and in these reports both pharmaceutical and agricultural interests were identified as enemies of regulation.

Accounts of bacterial resistance available to the general reader varied, sometimes framed in dramatic language that emphasized the emergence of “super bugs” like the “Andromeda strain,” and at other times presenting detailed reports of scientific meetings (*New York Times*, Oct. 15, 18, 1970; Feb. 6, 1972; Mar. 3, 1975). Concerns about the consequences of indiscriminate use of antibiotics were reflected in a Senate Health Subcommittee finding “that drug companies over-promote antibiotics to physicians and physicians overprescribe them, especially for colds and other viral infections that antibiotics can’t counter” (*Science News*, May 27, 1972). Information on the basic mechanics of “Transmissible Multiple Drug Resistance” (*Science*, May 19, 1972) became increasingly sophisticated in *Science*, *Scientific American*, and *Science News*. *Good Housekeeping* (March 1975) reported that the American Medical Association had discovered that resistant organisms, once largely confined to hospitals, were now also found in the community.

Reflecting a general frustration, the *New York Times* (July 16, 1971) reported on a 25-year sur-

vey of health care that found despite “spectacular scientific advances. . . many diseases that should no longer exist, such as TB, still do.” Data from the CDC reported pneumonia and gonorrhea resistance to antibiotics. A CDC research team estimated that 22 percent of antibiotic use in the hospital was unnecessary and led to “superinfection” (*New York Times*, Jan. 28, 1976; Nov. 10, 1976).

The FDA proposed policies (congruent with Britain and other European countries) to limit antibiotics in animal feed and reported that animals consumed more than 40 percent of the antibiotics produced. In a replay of an article that had appeared in the late 1960s, *Time* (Sept. 10, 1979) reported that the FDA-proposed limits were opposed “by a coalition of pharmaceutical manufacturers and farming interests.” Congress agreed “to stay any action pending further studies.”

■ 1980 to 1994

Reports of emergent and re-emergent diseases have often implicated antibiotic resistance. Tuberculosis, once slated for virtual eradication in the United States by the early 21st century, proved impossible to eliminate, and its persistence was linked to premature budget cuts in the nation’s public health efforts. But the blame for the re-emergence of tuberculosis was spread broadly. New cases of tuberculosis were often associated with homeless populations or with immigrants from areas of the world where the disease was endemic (*New York Times*, July 26, 1980, June 18, 1985); reportedly, attempts to control tuberculosis were exacerbated by patients’ failure to comply with extended treatment, which could lead to multi-drug-resistant disease.

In the 1980s epidemiologic and comparative international perspectives on antibiotic resistance became prominent for the first time. In 1981 doctors in medical teaching centers called for international controls “to halt ‘indiscriminate’ use of antibiotics” (*New York Times*, Aug. 6, 1981). Broader concern was reflected in reports from prominent spokespersons for the international

scientific and medical communities, as well as in reports of the dangers to Americans from multiple-drug-resistant organisms imported as a result of increased world travel, and via immigrants (often illegal) from developing countries.

Some diseases once treated by antibiotics were reportedly now out of control. CDC reports on the rise of antibiotic-resistant gonorrhea, streptococci, and hemophilus infections brought the danger closer to home when they were connected to children's ear infections and to the overwhelming (not antibiotic-resistant) infection that killed the Muppets creator, Jim Henson (*New York Times*, Feb. 23, 1989; May 8, 18, 1990; Jan. 28, 1992). The emphasis and tone of reporting on antibiotic-resistant bacteria shifted, markedly influenced by accounts of how infectious disease strikes back in the war between pestilence and people (*Time*, Sept. 12, 1994).

Time reported that the rising tide of antibiotic resistance affected "nearly every disease organism known to medicine"; the "microbe's extraordinary ability to adapt" was "a fact of life." The magazine reported that adaptation was "written into evolution," but few anxieties were relieved by reassurances that microorganisms were only "trying to. . . survive and reproduce, just as we are" (*Time*, Sept. 12, 1994).

Readers of popular magazines were challenged by articles such as "Are you **overdosing** on antibiotics?" (*Redbook*, December 1991). There was mounting tension between warnings of dangers from "the ghost of scourges from the past" (*U.S. News and World Report*, Oct. 26, 1992) and reports of FDA approvals of new antibiotics. As in the 19th century, doctors cautioned that "A Hospital is No Place for a Sick Person To Be" (*Discover*, October 1985), and patients feared that "Hospitals May Be Breeding Grounds" (*USA Today*, February 1991), as evidence mounted that "Hospitals Can Make You Sick" (*World Press Review*, August 1988).

Scientists and physicians were quoted in desperate moments as they drew dire conclusions for the future. A feature article, "The End of Antibiotics," quoted one physician's explanation that "microorganisms are winning" because

"they are so much older than we are . . . and wiser" (*Newsweek*, Mar. 28, 1994). With no new antibiotics ready for introduction and evidence of the existence of "smart bugs" that carry information in resistance genes, attention to misuse of antibiotics in medicine and agriculture competed for blame with human populations which were likened to hothouses for breeding of germs. Some reports downplayed professional accountability, shifting responsibility to social changes that included the spread of AIDS, the rise in homelessness, the proliferation of child care centers, the influx of immigrants, increases in international travel, and the disturbance of ecosystems in both economic development and recreation (*U.S. News and World Report*, Oct. 26, 1992).

A change of tone and target appeared in the 1980s. Partly as a consequence of lessons in immunology that accompanied publicity on AIDS, but also because bacterial genetics had become a growth industry, reports of new evidence on antibiotic resistance used adaptations of everyday language and diagrams to explain resistance genes to the public. Bacteria acquired identities of their own. They were pictured or perceived as willful beings governing their own mutations and transferring resistance genes to other bacteria in conscious efforts to outwit humans and their antibiotics. Journalists quoted scientists describing "bugs" with a crafty intelligence capable of becoming relentless demons.

■ Comments on the Popular Literature

Penicillin marked the beginning of a new era for most Americans and a majority of people around the world. However, from its very beginning the triumph of antibiotics was accompanied by fear that resistance might reverse the advantages gained over infections. Anxiety was expressed as concern that ordinary germs would take revenge, that miracle drugs were a two-edged sword, eliminating some bacteria and favoring others.

Over time the early warnings transformed into forecasts of apocalypse. Penicillin had not banished hospital infections as had once been

dreamed; instead, first “staph” and then other organisms became resistant. Unexpected disease and death spread among patients despite the efforts of infectious disease experts. Scientists discovered that bacterial resistance to antibiotics was transmitted among disease-bearing organisms in ways that were unimaginable before the availability of the tools of molecular biology. Scientists collaborated with journalists to instruct the public in the new language of resistance genes, and the American public read about unexpected outbreaks of untreatable mysterious infections in the 1960s and 1970s. But the 1980s appeared more dangerous yet. AIDS laid the groundwork for new fears, and fatal multiple-drug-resistant tuberculosis and streptococcal pneumonia put medical news and the terms “emergent” and “re-emergent” disease on the front page of newspapers and on bestseller lists.

According to Rosenkrantz (1995), the emergence or control of antibiotic resistance was posed first as a contest between knowledge and ignorance, then between control and irresponsibility, and ultimately between good and evil. The 1990s saw the stream of scientific and medical information merge with fears about social disorder and political corruption. The bearers of the new threat were often immigrants from Asia, Africa, and South America, where AIDS, tuberculosis, and other infectious diseases were prevalent and where antibiotics were unavailable or improperly used. The homeless, who failed to comply with treatment plans, were blamed for the spread of antibiotic-resistant tuberculosis.

Child-care centers and hospitals were singled out as places that spawn antibiotic resistance. But blame was not restricted to the powerless. Pharmaceutical firms and agribusiness were also incriminated on the basis of alleged irresponsibility and greed. Attributing the spread of antibiotic resistance to victims of disease as well as to representatives of corporate power accentuated public anxiety and seemingly placed control outside the realm of science. Meanwhile, it appears that fear of antibiotic-resistant disease has not eroded public demand for antibiotics. The placing of blame on the most vulnerable and the most powerful may have compromised the impetus for controlling patients’ inappropriate requests for antibiotic prophylaxis and therapy.

The problems with antibiotic-resistant bacteria are not new to this decade or even to this generation. Such bacteria were identified soon after the first use of antibiotics, and the technical and popular press has reported on them and the problems with which they are associated. Over the last 50 years, warnings have been voiced about inappropriate antibiotic use—too frequently demanded by patients, too heavily prescribed by physicians, too heavily used in agriculture, and too often used when they have no effect. The variety of possible explanations for the emergence of this public health problem highlights the complexity of the issues and also provides a number of approaches to control the problem, which are discussed elsewhere in this OTA report.