**Notification in Health Systems for Complications of Medical Treatments Discovered Retroactively:**

**Case Study of X-Ray Treatments for Ringworm of the Scalp in Israel**

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**Abstract**

This study seeks to examine the issue of notification in the Israeli case of radiation treatment for ringworm of the scalp (also termed ringworm of the scalp, tinea capitis, dermatophytosis, favus; hereinafter: “ringworm”), including the issue of knowledge of the risks of the radiation treatment given for the condition among professionals and patients treated for ringworm that were not known at the time of treatment but were discovered later in time.

Ringworm is a skin disease caused by dermatophyte fungus. In the Israeli ringworm case, people suffered health disorders that many years later were found to have been caused by the X-ray radiation treatments given to them to combat the disease over the years 1925–1960. Radiation for ringworm was given in Jewish communities in Eastern Europe between 1925–1939, in Mandatory Palestine from 1925, in Jewish communities in Northern Africa, in the transit camps for immigrants in the South of France in 1947, and in Israel by the Ministry of Health between 1948–1960. In 1960, following the discovery of a cure for the disease, radiation treatments were ceased. The number of patients in Israel who received such treatment, Jews and minorities, is estimated at about 31,400 children between 1925–1960. The link between exposure to X-ray radiation and later development of tumors in the head and neck was established in the mid-20th century, with numerous studies published in the medical literature in the late 20th century.

The ringworm case was selected as a test case as it represents an instance when the medical risk was discovered after treatment had already been provided. In addition, the treatments are extensively documented in medical and historical archives.

The study was planned in the form of a qualitative case study, facilitating a comprehensive examination of the different notification methods in the Israeli ringworm case and their impact, while combining qualitative and quantitative studies with the goal of reaching findings to assist in recommending the development of a model of notification in the medical system in similar instances where a risk involved in medical treatment is discovered retroactively.

The study’s research plan defined questions and hypotheses concerning, among others, the need to notify radiation patients about the risks when such are discovered; the entities responsible for notification; defining the audience for notification; the necessary methods of notification, and the response to the notification steps taken.

In Israel, the issue of the notification of ringworm patients who had received radiation treatment about the risk of developing tumors has yet to be fully examined in the academic literature. Even processes for notifying patients as to medical risks that are discovered retroactively have not yet been studied in depth in Israel, and has only partially been studied around the world. This study is innovative given that there has been no proper consideration of this issue by the health and legal systems, as well as the media, and because professional literature has yet to define it as a distinct area of research in all its aspects.

The importance of this study lies in its historical context and its potential for helping develop a prospective notification model for similar scenarios of risks of medical treatments already provided discovered after the treatments have been provided—scenarios that are becoming common today given the fast pace of technological advances in diagnostic medicine and genetic research. In addition, this study holds significance for the legal discourse surrounding the duty to notify and the debate over the role of media in notifying the public of medical risk—an issue that has become even more relevant recently in the era of the coronavirus pandemic.

In Stage 1 of the research, data was collected from historical archives in Israel and from a literature review. Further data was gathered in Stages 2 and 3 from questionnaires distributed among doctors and social workers, respectively. During Stage 4, data was collected from an examination of patients treated with radiation against ringworm as children. The research plan was approved in 2015 by the Human Subjects Research Committee at the Ben-Gurion University Faculty of Health Sciences, and was reapproved in 2017 by the same Committee. The study was conducted with the support of the Gertner Institute, the National Center for Compensation of Scalp Ringworm Victims, and it received grants from the National Insurance Institute and the Israel National Institute for Health Policy Research.

**Stage 1: Descriptive-Historical Research into the Methods of Notification in the Ringworm Case**

This stage combined a descriptive historical narrative based on collecting data related to notification in the ringworm case from 13 historical archives together with findings from the professional literature. The collection of the archival data was performed through subjective sampling and document analysis based on criterion analysis. The criterion was generally defined as disclosure/notification with regard to the ringworm case. The sampling process emphasized identifying documents described as having evidentiary value, in that they had documentary value related to the research question. The documents were analyzed according to a qualitative descriptive method through qualitative interpretive content analysis according to the analytic induction approaches of grounded theory and critical analysis discourse.

The analysis of the historical documents and the professional literature review at this stage illustrates how the ringworm case was an unusual one for Israel and is unprecedented in scope compared to other countries around the world where conventional X-ray treatments for ringworm were also documented up to 1960. The analysis reveals many notification methods used in Israel, which were also customarily used around the work in similar notification procedures regarding risks involved in medical treatments discovered retroactively. These included: use of the media for notification; use of medical journals’ “letter to members” to notify doctors so that they could serve as intermediaries for notifying the public; the publication of the enactment of the Ringworm Law in 1995; and notification through announcements in the media and public awareness campaigns. Another notification strategy used in similar cases around the world, but not in Israel, notwithstanding significant professional and legal debates about it, was personal notification of radiation victims. The plethora of notification methods may indicate a lack of prior planning about the notification as well as the lack of an orderly plan for informing the public about the situation. Evidence was collected to demonstrate that the different notification methods did provide knowledge to some patients, similar to results found in the medical literature regarding notification efficacy to victims of radiation exposure due to ringworm treatment.

Findings collected at this stage provide evidence of notification procedures performed around the world in similar circumstances where a risk involved in a medical treatment was discovered retroactively, including the cases of: Vioxx, a pharmaceutical recalled in September 2004 after studies linked its use to an increased risk of cardiovascular events; Eltroxin, a pharmaceutical that underwent changes in its formula in 2010 that were not originally disclosed to the public and that led to increased reports of side effects; the DES (diethylstilbestrol)hormonal treatment once given to pregnant women in the mid-20th century and later discovered to increase the risk of cancerous tumors among patients and their children; and Thalidomide, which was used in the past as a sedative and as treatment against nausea for pregnant women and was recalled in 1961 by most countries following mounting evidence that it significantly increased the risk of severe fetal defects.

During this stage of the research, we also examined the specific aspects of notification in the ringworm case, including: legal aspects arising from a line of judicial opinions that compelled the state to compensate radiation patients for “failure to notify;” ethical aspects, including professional articles that extended the duty of notification and warning, now widely recognized today as an essential ethical duty in the medical field; and media aspects, addressed in numerous academic publications emphasizing the importance of the media as an influential factor in the procedures of informing the public about risks involved in medical treatments.

**Stage 2: Doctors**

**Background**: This stage involved a quantitative study using questionnaires to explore the issue of notification in the ringworm case among Israeli doctors. The study was designed as a national survey among Israeli doctors who may have treated people affected by ringworm radiation, in light of the physicians’ role as potential intermediaries for passing on knowledge within the health system that may be useful for their patients, and as active participants in improving the quality of medical care.

**Methodology**: The study was conducted using a knowledge questionnaire based on questionnaires from previous studies examining knowledge among doctors regarding medical services and on questionnaires based on the Likert scale. The questionnaire included 24 substantive questions and 9 demographic questions. The questionnaires were anonymous and the study’s protocol was approved by the Helsinki Subcommittee on Non-Medical Research on Humans at the Sheba Medical Center (hereinafter: "Helsinki Subcommittee").

The questionnaires were distributed between August 2014 and August 2015 via the internet by the PharmaQuest company, which holds databases for employed and retired doctors in Israel, at medical conferences, and through direct outreach via email to members of the Israel Radiological Society. The questionnaires were distributed among 6,395 doctors with expertise in fields that made it likely that they treated victims of ringworm radiation treatments: family doctors and general practitioners, internists, dermatologists, neurologists, psychiatrists, radiologists, EEG doctors, hematologists and oncologists. The goal was to make the questionnaires as accessible as possible to as many doctors as possible, without a predetermined sample.

The findings were analyzed using a SAS®9.4 program. The significance level for examining correlations between variables was defined using a chi-square test. Open-ended questions were coded by a team that included the research partners, in consultation with a radiologist and senior professionals at the National Center for Compensation of Scalp Ringworm Victims.

**Findings**: Of the 876 doctors responding to the questionnaire, 819 responded via the internet and 57 responded on the printed questionnaires distributed in conferences. A low response rate (13.46%) was documented from doctors included in the sample. Consequently, we conducted a parallel examination of demographic data of doctors in Israel up to the age of 65 in the relevant areas of expertise, based on data from the Ministry of Health. This examination revealed an age and gender distribution among all physicians in that age group in the relevant fields similar to that among the study’s responding doctors.

The analysis shows that following a knowledge score given to each study participant, close to half of the responding doctors (42.62%) were not familiar with the later effects of radiation treatment for ringworm. Widespread unfamiliarity was also documented among doctors defined as “secondary specialists,” to whom the Israeli health system requires a referral by a primary doctor (48.2%), and later among “primary doctors”—family doctors and general practitioners (43/37%)—and “primary specialists (29.85%),” none of whom require a referral.

When analyzing physicians’ knowledge about Israel’s Compensation for Ringworm Victims Law, enacted in 1994, and the National Center for Compensation of Scalp Ringworm Victims, which was launched in accordance with the terms of the law, close to two-thirds of doctors questioned had no knowledge at all about the existence of the Center (63%). Even among those who were aware of the Center’s existence, most did not know details of its location in order to refer potential patients to it (66%.) In addition, many of the doctors, among them approximately half of the secondary doctors (46.85%), were not aware of the law, which could be relevant for their patients (42.11%,) Almost all participating doctors exhibited a lack of awareness as to the level of risk involved in ionizing radiation (94.74%).

Examining the sources of knowledge about the ringworm case, we found that most doctors in the sample had acquired information from scientific journals (33.25%), medical schools (15.2%), the media (8.09%), and even from patients (7.45%). Respondents were far more likely to acquire information from these sources than from those ultimately responsible for their actions—the state’s Ministry of Health, which was responsible for carrying out the treatments, and the health funds that serve as the direct employers of most of the doctors in the community included in the sample (6.8%).

The chi-square test for examining the link between the knowledge score regarding the ringworm case and the doctors’ information sources showed high levels of knowledge among doctors who reported receiving information about the ringworm case from the Ministry of Health and the health funds. These results indicate that had the regulatory authorities successfully distributed proper notices on the subject, the knowledge score regarding the ringworm case among doctors could be expected to be higher.

**Methodology—Expansion**: Based on the findings, it was decided to expand the study in order to strengthen its validity and to carry out an in-depth examination of the knowledge patterns of primary doctors about medical services that could benefit their patients. Articles in the field of ethics emphasize the importance of doctors referring their patients to treatments that could benefit them and the doctors’ duty to be updated on relevant information about essential services to patients. Even from a legal perspective, in light of court decisions on the issue of notification in the ringworm case, among other factors, there appears to be a growing tendency among courts to compensate patients who were not referred to services relevant to their conditions.

**Methodology—Expansion**: The new study included doctors in the Israeli community defined as primary doctors**—**family doctors, pediatricians and general practitioners, as well as specialist doctors who do not require a referral: gynecologists, orthopedic doctors, eye doctors, EEG specialists, dermatologists, and dentists who were added to the sample after the planning phase for the purpose of examining specific services.

The study questionnaire included 37 professional questions regarding services that targeted the doctors in the relevant specialties and 10 demographic questions. The study included a repeat examination of doctors’ knowledge about the ringworm case, the Compensation for Ringworm Victims Law and the National Center for Compensation of Scalp Ringworm Victims established in accordance with the law. It also examined knowledge about services for quitting smoking, children’s dental care, mental health, pain clinics, testing for early diagnosis of colon cancer, nutritional advice for those suffering from excess weight, hearing aids for the elderly, and compensation for victims of vaccines. For each service, the relevant primary doctor’s knowledge level was examined, as well as the patterns of referral to services. The questionnaires were anonymous and this study protocol was approved by the Helsinki Subcommittee.

This new study questionnaire was distributed in September 2017 among 9,422 doctors via the internet using a database run by PharmaQuest, at medical conferences, and through direct outreach via email to members of the Department of Family Medicine.

The findings were analyzed using a SAS®9.4 program. The level of significance for examining the correlation between variables was defined by the chi-square test, and a multivariable processing (logistic regression) was performed to determine the influence of the dependent variables on the independent variables. Open questions were coded in consultation with research partners in April 2018, after completion of a minimal quota of 381 predetermined participants.

**Findings—Expansion**: The final sample included 780 doctors, 732 of whom completed the internet forms and 48 of whom responded at conferences. The study’s final response rates were low, and an examination was performed to compare the responding doctors’ data to that of the general population of doctors in Israel, according to data from the Ministry of Health. This examination pointed to a similar demographic distribution between the study’s respondents and the general physician population in Israel.

The findings strengthen the original study’s findings as to low levels of knowledge among Israeli doctors of the services for compensating ringworm victims. However, the extent of the knowledge was lower in this second study, and about a third of doctors (31.2%) were unfamiliar with the Compensation for Ringworm Victims Law, including most of the dermatologists (77.5%).

Examination of information sources regarding the ringworm case also supported the original study’s findings, with patients serving as a central source of information regarding the law and the National Center for Compensation of Scalp Ringworm Victims (45.41%), at rates even higher than for those of the health authorities: the Ministry of Health (37.84%) and health funds (24.86%). Additional sources of information regarding the ringworm case, as documented in the expanded study, included media (29.73%) and, at lower rates, scientific journals (8.11%), and conferences and training sessions (4.86%.).

The doctors participating in the expanded study also showed a lack of knowledge about additional medical services raised in the questionnaire beyond the ringworm case, including lack of knowledge about: resources for quitting smoking that are provided by Israel’s health funds; children’s teeth-brushing habits after introducing children’s dental services into the public health funds’ basket of services; issues relating to mental health care in the public health system; the inclusion of colonoscopies in the public health funds’ basket of services; and about the Committee for Compensation of Vaccine Victims and the means of applying to the committee. The study documented significant disparities in knowledge sources for primary doctors regarding the additional services examined, with the main sources being the health funds, the Ministry of Health, and conferences and trainings, in descending order of level of informativeness.

**Conclusions**: The findings of studies among doctors in Israel point to a vast lack of knowledge regarding the ringworm case generally, and regarding the Compensation for Ringworm Victims Law and the compensation plans specifically. In fact, given the low response rate in both studies, Israeli doctors’ knowledge of the ringworm case may even be lower than that documented. However, the second study showed a moderation in their lack of knowledge in this matter that is consistent with increased intentional notifications for doctors regarding the ringworm case that began following a precedent-setting court ruling in 2015, after our first study had already commenced.

The lack of knowledge about the ringworm case among secondary specialists may stem from the nature of the specialization trend in medicine, which involves in-depth consideration of a single medical condition, often at the expense of observing the patient as a whole, a phenomenon well-documented in the scholarly literature. In our study, a lack of knowledge was documented specifically among psychiatrists, EEG doctors, radiologists and hematologists, which is consistent with the findings of other works that examined knowledge among specialists. Doctors’ lack of familiarity with the Compensation of Ringworm Victims Law is also consistent with findings of other studies that show a lack of knowledge among doctors in matters related to legislation and regulation in the areas of health and medicine, including lack of knowledge about safe levels of ionizing radiation exposure.

In both studies, scientific journals were identified as the leadings source for information about the ringworm case, 33.25% in the first study and 45.41% in the expanded study, thereby indicating that these journals are a central source of information for the medical community. Other research also supports the centrality of the media as a source of information.. The finding indicating the central role of patients as sources of information for doctors in the ringworm case is both novel and surprising, perhaps because it has not been studied to date. The study results attest to the failure of official Israeli regulatory bodies, particularly with regard to health authorities, to serve as significant sources of information for doctors regarding the ringworm case, as well as the additional conditions examined in the expanded study.

The findings emphasize the importance of Israeli health authorities passing on information to doctors in the country regarding the ringworm case and its potential damage. This position was also emphasized in various court decisions regarding the issue of notification.

**Stage 3: Social Workers**

**Background**: Using an iterative process to further examine and deepen the study’s findings and in light of the earlier stages’ findings indicating a lack of sufficient knowledge among Israeli doctors about the ringworm case and the subsequent law and compensation plan responding to it, we decided to examine the levels of knowledge on these matters among medical social workers who are responsible for referring patients to different services.

In a 2015 report, Israel’s State Comptroller found that because the health system did not provide patients and their family members with systematic and full information about their rights, the positions and authority of social workers in medical settings needed to be strengthened to address this situation. Indeed, the code of ethics of Israeli social workers emphasizes the importance of making information regarding essential services accessible in order to ensure equal opportunities in society.

**Methodology**: A questionnaire was drafted for the study and distributed among medical social workers in Israel. The questionnaire was anonymous and included 17 knowledge questions and 7 demographics questions, based on the knowledge questionnaire distributed among doctors in Phase 2 of this study. At first, the questionnaire was distributed through outreach to heads of social services in 19 medical centers in Israel. After receiving responses from 39 social workers from only two centers, it was decided to turn to online distribution to expand the possible pool of participants, using the IMKForms® software through professional groups on the Facebook social media platform.

The study’s findings were analyzed using descriptive statistics in IBM\_SPSS\_25® software. Correlations between variables for examining the likelihood regarding knowledge about the Compensation for Ringworm Victims Law and harmful effects following radiation treatments for ringworm were examined using a chi-square test. Later, the phi coefficients and odd ratio were calculated to estimate the effect size.

**Findings**: There were 101 medical social workers who responded to the study questionnaire. Such medical social workers work at general, psychiatric, geriatric, or rehabilitative hospitals and in health funds.

Although most respondents (66.3%) were aware of the harmful side effects caused by radiation treatments generally, less than a half of those (40.6%) were knowledgeable about the harmful side effects that could have been caused by ringworm radiation treatments. In addition, while most of the participants were familiar with the Compensation for Ringworm Victims Law (65.3%), less than a quarter (23.8%) knew about the existence of the National Center for Compensation of Scalp Ringworm Victims, so that very few were actually able to refer potential patients to it. Familiarity with the law was documented mostly among social workers employed at general hospitals and health funds, and lack of familiarity was reported mostly among social workers employed at general and psychiatric hospitals.

Most respondents familiar with the ringworm case heard of it after the year 2000 (56.6%), and only a minority heard about it in the 1980 and 1990s during the first notification campaigns described in Phase 1.

Examining the sources of the information, over half of participants (56.4%) were unable to recall how they became aware of the ringworm case, and among the rest, the primary sources of information were patients (20.8%) and the media (20.8%), similar to the findings observed among doctors in Phase 2. However, most participants would have preferred to receive the information about the case directly from the Ministry of Health (68%) or via the internet (45%).

Almost a fifth of participant (17.8%) reported that they were aware of having had treated patients in the past who had undergone radiation treatment for ringworm radiation in their childhood and less than a fifth (15.8%) were aware that they had treated patients who had filed a claim for compensation. A statistical analysis revealed that social workers reporting that they had treated radiation patients were 27.08 times more likely to be familiar with the Compensation for Ringworm Victims Law compared to others, and social workers who reported that their patients had filed claims for compensation were 23.20 times more likely to be familiar with the law.

**Conclusions**: This is the first study to examine knowledge about the ringworm case among Israeli social workers. A significant lack of knowledge among about a third of participants is consistent with other studies that examine knowledge among social workers employed by the health system. These results point to gaps between the moves to encourage social workers’ increased involvement in medical institutions and to expand their professional identity and scope of responsibility in medicine, and actual practice, characterized by a lack of involvement and at times even resistance to adopting practices that advance patients’ welfare and social change.

A vast lack of knowledge documented among social workers employed in psychiatric institutions is consistent with the finding from Phase 2 among psychiatrists and is consistent with additional studies regarding the lack of knowledge among social workers operating within the field of psychiatry.

Social workers’ lack of knowledge regarding the medical consequences of radiation treatments is troubling, especially in light of Israeli courts’ view that medical teams must notify patients of the possible side effects of these treatments. Exposing social workers to developments in the ringworm case, primarily from 2000 onward, is consistent with the case law regarding notification in these cases that has emerged since then, and the notification campaigns advanced in their wake.

The media’s centrality as a source of information for social workers about the ringworm case demonstrates the significant role popular media has in raising awareness about not only the ringworm case, but about public health issues in general, including among social workers. However, according to the professional literature, the media also plays an important, albeit potentially harmful, role in shaping negative public opinion about social workers in such a way as to undermine faith and trust in their work.

**Stage 4: Ringworm Radiation Patients**

**Background**: This study examined the issue of notification among ringworm radiation victims based on actual documentation from cases filed by people with the National Center for Compensation of Scalp Ringworm Victims.

The study was planned with a descriptive approach as a combined quantitative-qualitative study for examining the issues concerning the hypotheses regarding notification in files, as reflected when they contacted the National Center for Compensation of Scalp Ringworm Victims, including their attitude to Israeli authorities associated with the ringworm case.

**Methodology**: The study was performed according a well-organized research protocol by analyzing the files of patients at the National Center for Compensation of Scalp Ringworm Victims which underwent a data anonymization process. Six hundred patient files were sampled in a stratified purposeful sampling in order to identify distinctions between various population groups, with the criterion for inclusion in the sample the presence of a claim filed with the National Center for Compensation of Scalp Ringworm Victims between 1995–2014. The files were sampled according to sex and the time of contacting the Center, in a format of 300 files of men and 300 files of women, with a sample of 30 files for each of the years examined: 15 first files in January, with 8 of men and 7 of women; and 15 first files in July: 7 of men and 8 of women. This research protocol was approved by the Helsinki Subcommittee.

Data collected from patient files were analyzed quantitatively through descriptive statistics in the IBM\_SPSS\_25® software and correlations between the variables were examined using the chi-square test. Verbal data extracted from the files was analyzed using a qualitative method according to the principles of grounded theory and using systematic content analysis for the purpose of defining categories and sub-categories.

**Findings**: The final sample included 527 patient files from the National Center for Compensation of Scalp Ringworm Victims: 264 men’s files and 263 women’s files. The sample identified 302 files where no development of tumors as a result of the radiation treatments were reported. In such files that included mental injuries and/or baldness, new communications to the National Center for Compensation of Scalp Ringworm Victims were documented throughout all the reviewed years (1995–2014,) with a spike in the number of suits filed between 2001–2002, which reflects partial awareness of the Center’s existence.

On the Center’s intake forms, most patients included in the sample did not hold any authority responsible for the radiation treatments they had undergone. Nonetheless, the quantitative analysis revealed that nearly half the claimants (42%) explicitly named a specific authority or entity as responsible for the radiation treatments, and, of them, a high percentage placed responsibility on the Ministry of Health (25.3%), the country in general (23.1%), and the Jewish Agency and the American Jewish Joint Distribution Committee (also known as “the Joint”) (28.1%), which were involved in providing treatments in their countries of origin for Jews seeking to immigrate to Israel. Among those whose files showed diagnoses of trauma, native Israelis who had received radiation treatment for ringworm were more likely than Israelis of foreign origin or those who had received radiation treatment for ringworm abroad before moving to Israel to place responsibility for the treatments on a particular entity.

Analyzing the data from 221 files of patients who placed responsibility on a particular entity, patients who underwent radiation treatments in childhood were more likely to place responsibility on the Ministry of Health (33.6%,), the state (26.8%,), and health funds and hospitals (19.5%), compared to those who underwent treatments in other countries, who were more likely to place responsibility on the Jewish Agency and the Joint (77.8%). Patients with psychiatric diagnoses were more likely than others to hold the state responsible, and patients without a psychiatric diagnosis were more likely to place responsibility on the Ministry of Health. Patients from the Arab population tended to place responsibility for treatments on the Ministry of Health, compared to a minority of Jewish patients. Men were more likely than women to place responsibility on the country in general, whereas women were more likely to place responsibility on the entities operating abroad. Individuals who filed their compensation claims before age 65 were more likely to place responsibility on Israel’s health authorities, whereas older claimants were more likely to place responsibility on entities that operated abroad.

In the qualitative analysis, 20 cases revealed the ways in which patients were informed about the link between the radiation treatments and the risk for later complications, and it was found that several patients received this information inadvertently.

The narratives analyzed from the claimants’ files were categorized into six general categories regarding attitudes toward the ringworm case: suffering in terms of the radiation treatments; compensation demands; references to the DDT spraying which was another treatment given to immigrants and residents against malaria at the time; references to metaphors related to the Holocaust; association between the radiation treatments and difficulties in broader areas of life; and anxiety about the future. Subsequently, categories regarding the attitudes about level of severity of the ringworm radiation treatments were defined: viewing the radiations as a “mess up;” a wrongdoing; a humiliating event; a “tragic event;” a trauma event; a rape; a negligent event; torture; abuse; hell; a crime; and a murder.

**Conclusions**: A distribution in terms of the timing in which the claims were filed may be indicative of a lack of awareness among some patients as to the existence of the National Center for Compensation of Scalp Ringworm Victims. A spike in the number of suits filed after the year 2000 is consistent with findings from Phase 3 among social workers.

The likelihood of placing responsibility in the ringworm case on some entity as observed in the study reflects a growing process of distrust for the health system among patients, which has been documented in recent years in other studies, including around the management of the coronavirus pandemic over the past year.

The likelihood that claimants born in Israel and receiving radiation in Israel of placing responsibility on a particular entity may result from these patients’ greater familiarity with authorities and the level of such authorities’ involvement in the case. It may also reflect a growing trend in Israeli culture to place responsibility on identifiable parties for a broad range of issues, including complications discovered about medical treatments, as demonstrated by other studies. The greater likelihood that younger patients will place responsibility on Israeli health authorities may reflect an increased tendency among the younger generation to criticize authorities and identify them as responsible for failures.

**General Conclusions**

The existence of multiple sources for notification regarding the ringworm case as documented in the study may demonstrate a unique approach to notifying ringworm patients in Israel, the only country in the world to have enacted a law designed to compensated radiation patients who later developed complications. Nonetheless, even Israel’s response shows a lack of planning and the absence of a clear plan to notify the public on the matter. Articles in the professional literature point to a lack of planning in aspects related to notification even in other medical risk situations during periods of emergency, including during the coronavirus pandemic outbreak over the past year.

The findings of this research in terms of the methods of notification in the ringworm case do not conform with court rulings, especially as expressed in the precedent-setting decision in the matter of Sima Reuven and the case law that followed. On the other hand, the study presents evidence that the legal rulings did have an impact on making changes in Israel’s notification methods in the ringworm case.

The study identifies knowledge gaps about the ringworm case both among professionals—doctors and social workers—and among patients. The significant lack of knowledge documented in psychiatric institutions by this study in Israel, which is consistent with other studies, may be related to the complex risk management that characterizes these institutions.

In examining the sources for information about the ringworm case, the study points to the relative marginality of the formal sources of information—the state health authorities, meaning the Ministry of Health and the health funds—in notifying professionals and patients as to the ringworm case. This phenomenon is also reflected in several studies in the medical literature. Scientific journals serve as the central formal means of notification about the ringworm case among doctors, but as a negligible means of notification among social workers, a finding that emphasizes gaps in the importance of professional literature in the health system. Popular media is identified as a significant contributor to notification in the ringworm case, albeit an indirect and informal means of notification. One of the study’s most interesting findings is that patients were identified as a major means of notification about the ringworm cases for professionals—doctors and social workers. There are a few examples in the professional literature of similar scenarios where patients serve as a source of information for professional teams in the health system. This trend has recently increased with the emphasis on the importance of patients’ reports of side effects and complications in treatments, and in research that points to the contribution of exposing professional teams to patients’ experiences as a way to improve the quality of care.

The study’s findings demonstrate the inherent tension between the health system and the legal system. The study’s findings are an example of the trend documented in recent years regarding the growing distrust toward governmental systems generally, and the health system specifically.

**The Study’s Limitations**

The study has several general limitations: the implications of the historical affair of the ringworm case raise concerns regarding the loss of information or the construction of information; power relations in the field may affect the data collected; limited search of archival documents; the methodological limitations of case studies; and technical limitations that prevent the study’s access to certain populations.

In the study of doctors and social workers in Phases 2 and 3, there is a possibility of memory bias regarding the ringworm case; the limitations of a knowledge questionnaire that may be perceived as insulting; and technical limitations related to the ways in which the questionnaires were distributed, including self-selection bias expressed in the possibility that certain participants are more likely than others to complete online questionnaires. In the study of patients in Phase 4, there are technical limitation resulting from the collection of data from anonymized files, including information in illegible handwriting, incomplete documentation, memory bias and limitations related to the nature of the field in which the study was conducted—the National Center for Compensation of Scalp Ringworm Victims. Because this may be a biased field, it is possible that some of the patients referred to the Center overly emphasized their distress, and that some of them were referred by lawyers and other advisors for purposes of recounting their reports.

**The Study’s Recommendations**

Consistent with the original research plan, the research findings lead to a list of recommendations related to developing a model for notification in circumstances of retroactively discovered complications from medical treatments.

The findings point to a need in raising the awareness of Israeli doctors and social workers about the retroactively discovered complications of radiation treatment in the ringworm case and about the possibility of such situations arising with other treatments that are essential to their patients in order to improve care within the health system, including through professional literature, media, and programs for professional training. The findings emphasize the importance of deliberate notification activity regarding the ringworm case and the importance of passing information about the case from health authorities to Israeli doctors. The findings identify the need to promote doctors’ awareness about the harms of ionizing radiation in medicine.

The findings also emphasize the need to develop methods for increasing trust in the health systems. It is recommended to target these efforts particularly to groups which have a stronger tendency to place responsibility on the health authorities, as identified in the study, in order to assist patients and the public in relating and communicating with health authorities, and in order to strengthen public trust. The findings highlight the need to increase the transparency trend in terms of notification by government institutions in the medical and health fields toward the general public, and especially toward those harmed by medical treatments, particularly now when access to updated medical information that may be used for purposes of notification is increasing. Preparing a clear strategic plan for notifying the public in circumstances of retroactively discovered medical risks, such as in the ringworm case, may facilitate authorities’ better control of the information that is provided and the ways in which it is perceived among the public, thereby increasing public trust in the health system.