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# Architectural and Structural Engineering of the 19th and 20th Century Psychiatric Hospitals with Respect to Fire Causes and Mitigation Strategies

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## ABSTRACT

This paper sheds light on civil facilities that home the underrepresented and overlooked population with mental illnesses. More specifically, this paper examines the primary architectural engineering features of psychiatric hospitals from the lens of fire hazards. Psychiatric hospitals rose in popularity in the 19th century for individuals deemed "unfit" to live with the sane population. While they began with good intentions, these hospitals came to represent practices and poor living conditions for mentally ill patients. These conditions, when combined with a wide variety of mental illnesses, resulted in increased risks. One of the most significant risks in psychiatric hospitals was fire – with nearly all psychiatric hospitals examined herein experiencing at least one structural fire despite premier fire control inclusions. A brief history of psychiatric hospitals is presented first, followed by a discussion on various aspects of structural fire design. Then, an analysis of structural fires in psychiatric hospitals throughout the world is then performed, and three general and common fire causes and mitigation strategies are presented. By understanding where past architects and designers lacked in designs for vulnerable populations, perhaps current and future professionals can better mitigate fire risk in healthcare design.

## PRACTICAL APPLICATIONS

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This paper examines an often overlooked portion of the world's mental health history by shedding light on one of the most significant risks associated with 19th and 20th century psychiatric hospitals: fire. A brief introduction to historic mental health facilities and their populations is presented first and followd by a discussion on fire control methods of the past. Then, seven prominent facilities, or *asylums*, with a history of fire are analyzed for cause and mitigation strategies. As a result, three prominent contributions are discussed and include architectural and structural design, fire mitigation methods, and population characteristics. The goal of this analysis is to increase awareness of the many and broad vulnerabilities of populations (past and present) such as the mentally ill when placed in care facilities. By understanding where past architects and designers lacked in designs for such people, perhaps current and future professionals can better mitigate fire risk in healthcare design.

*Keywords*: Psychiatric hospitals, Fire hazards, Architectural engineering, Mitigation strategies.

## INTRODUCTION

First established in the United States in the mid-19th century, psychiatric hospitals (asylum institutions) were home to anyone deemed unfit to live with the general population, including the mentally ill and criminals (Clarke 2021). The rise of asylums was primarily based on the idea that institutions could provide the specialized care required to improve and cure a multitude of mental illnesses. Unfortunately, this was not the reality for most patients, and several factors contributed to long-term stays, overcrowding, and poor treatment.

With time, asylums became custodial care facilities where patients went to live until they died (Hensley 2010). This, when combined with the existing high admission rate of patients, led to unsustainable population growth within existing asylums. For example, this trend can be seen in the St. Louis Lunatic Asylum, which was originally meant to house 350 patients and then doubled in size. With a cure rate of just 10%, most patients were never discharged (Hensley 2010).

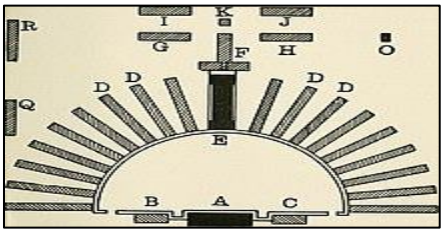
In addition to overcrowding, a lack of funding also overwhelmed many institutions. Patients and families alike often refused to pay for asylum care, patients because family members admitted them against their will, and families because they believed the mental illness was not their responsibility. In the end, the lack of paying patients and overcrowding resulted in a shift toward immoral treatment techniques, poor maintenance and construction of new facilities, and an increase in infectious diseases—conditions that were only reduced with deinstitutionalization in the mid-1900s (Yohanna 2013). Aided by the invention of the first antipsychotic drugs in the 1950s and Medicare and Medicaid shortly after, deinstitutionalization supported returning psychiatric patients to their homes. Unfortunately, this occurred regardless of a patient's cure status, and many found they were no longer welcome in their families. With the official closure of most asylums by the end of the 20$^{th}$ century, former patients were left with few remaining options as to where to live, and many ended up in poor houses or prisons (Torrey 1998).

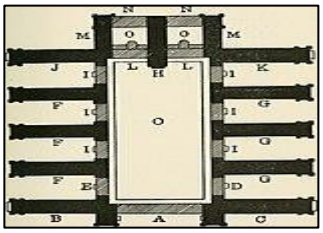
Regardless of the medical treatment practices during this time, superintendents and Moral Era reformers converged that fresh air and sunlight could cure patients (Yanni 2007). While this occasionally manifested as new treatments, it most prominently affected the location and design of asylums. For example, fresh air and sunlight require a significant amount of open space.

Therefore, new psychiatric hospitals built during this period were often located on extensive acreage outside city centers (D'Antonio 2022).

Underdeveloped transportation also required asylums to become self-sufficient. On-site farms, gardens, and entertainment methods were common, and patients were often required to work as part of their treatment. The beliefs of asylum leaders like Benjamin Rush and William Tuke customized this conglomerate of specialized facilities and large rural locations. As a result, architectural plans ranged in size and style throughout the beginning of the era. Corridor, Radial, and Pavilion plans were common, as demonstrated in **Figure 1.**


a)





b) c)

**Figure 1:** a) Corridor plan, Raleigh, North Carolina, 1872; b) Radial plan; c) Pavilion plan [Image a) by C.N. Drie, courtesy of Library of Congress, Geography and Map Division; images (b and c) reprinted from Hammond 1891.]

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However, a few designs became as popular such as the Kirkbride Plan (see **Figure 2).** The Kirkbride Plan was developed by Thomas Story Kirkbride, superintendent of the Pennsylvania Hospital for the Insane (Allen, Hall, and Rosenberg 2019). Kirkbride was a strong believer that the architecture of an asylum could inherently cure patients (later termed "architecture as a cure"). As a result, his design included specifications for landscaping its grounds and daily operations and a very distinct building shape. This "batwing" shape consisted of two stepped wards on each side of a central administration building. Each ward was first separated by the two genders and further segregated by mental health conditions. The most excitable patients were kept on the periphery of the building so that, as their condition improved, they would be transferred inward (toward the building exit) (Allen, Hall, and Rosenberg 2019).

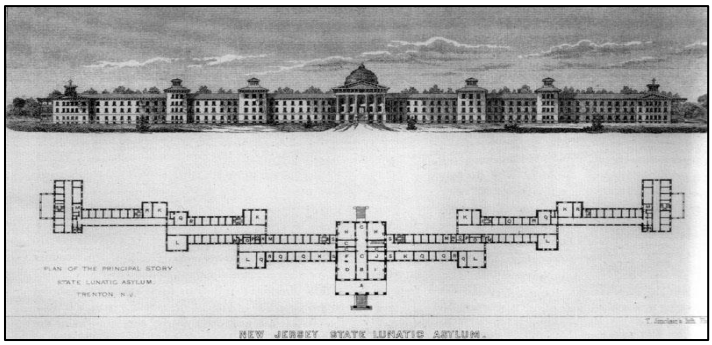


**Figure 2:** Kirkbride design blueprint for New Jersey State Lunatic Asylum, circa 1848. (Wikipedia Commons/Drown Soda.)

In addition to separating patients, the Kirkbride Plan's stepped shape also allowed for each section of the hospital to receive maximum light and ventilation and a homelike feel. Airflow was aided by large windows, open-concept corridors, and high ceilings—all described in exact detail in (Kirkbride 1854). Thus, the surrounding grounds and gardens could be viewed from nearly every

location in the building. In addition, each section of the hospital was meant to act as an "ideal Victorian family unit" (Allen, Hall, and Rosenberg 2019).

Patients worked together to complete daily activities and chores, doctors often had meals with their patients, and even ward nurses acted as the maternal entity of the unit. This, along with comfortable homelike furnishings such as wooden dressers, ornate rugs and curtains, and an allowance of personal furniture for wealthy patients, provided residents with a calm and familiar environment to facilitate healing.

The Kirkbride Plan became the primary architectural design for American asylums almost immediately after the release of Kirkbride's design guide. For example, the number of psychiatric hospitals in America grew from 18 in 1840 to 139 by 1880 (Allen, Hall, and Rosenberg 2019). Most of these new facilities were advocated for by the prominent mental health reformer Dorothea Dix, an adamant supporter of the Kirkbride Plan and moral treatment (Norwood 2017). Working in conjunction with Thomas Kirkbride, Dix successfully gained support for 20 state-funded Kirkbride plan hospitals over her lifetime, and many more were credited after her death (Parry 2006).

By the middle of the 19$^{th}$ century, these hospitals became synonymous with not only the curative ability of architecture but also a local town's social and civic achievement. Asylums were a source of jobs, financial stability, and pride for closely-located American small towns (Allen, Hall, and Rosenberg 2019). Additionally, their elaborate architectural styles were celebrated among locals—their designs often appeared on local postcards—and stone and iron construction made them some of the safest and most advanced buildings of the time (Bogdan and Marshall 1997).

Unfortunately, Kirkbride asylums rarely functioned according to their founder's specifications. An original capacity of just 250 patients contributed significantly to the overpopulation and subsequent financial difficulties that plagued nearly every institution by 1900 (Kirkbride 1854). In an effort to combat this issue, many asylums were expanded with poorly constructed wooden additions, and new asylums were simply built to hold a larger number of patients.

The Buffalo Hospital for the Insane, for example, was approved in 1866 for 600 patients. This resulted in a massive structure that took 20 years to build. In addition, the asylum was continuously understaffed, and a low cure rate resulted in a population of approximately 3,600 patients at its height (Allen, Hall, and Rosenberg 2019; Higgins 2019). The Buffalo Hospital for the Insane was not unlike many other Kirkbride buildings of the time: overcrowded, understaffed, and in disrepair. As a result, many denounced the Kirkbride Plan for its failure to heal patients in the ways it was originally intended, and a new architectural design quickly emerged to take its place.

The Cottage Plan was, therefore, an attempt to fix the problems of the Kirkbride Plan while continuing the belief that architecture could be therapeutic. It included small cottage-like buildings arranged to resemble a village or college campus. Each building could be modified as needed, and patients could be supervised in a more organized fashion (Carlson 2016). In addition, the Cottage Plan allowed for greater specialization of psychiatric treatments and division of patient illnesses. Buildings rarely held more than 20 patients, groups of which were typically each assigned to work on the campus (farming, gardening, laundry, etc.). This approach to asylum architecture was inherently more homelike than the massive, elaborate Kirkbride buildings; allowed for nearly

infinite expansion; and reduced construction costs. The Cottage Plan continued as the design of choice through the deinstitutionalization of asylums in the mid-1900s.

This paper sheds light on asylum history from the lens of fire hazards, as completed by analyzing seven prominent structural fires in asylum history. Three causes of such fires are determined and explored to educate the reader on an underrepresented and overlooked portion of the world's mental health history. By understanding where past architects and designers lacked in designs for vulnerable populations, perhaps current and future professionals can better mitigate fire risk in healthcare design.

## THE ASYLUM FIRE PROBLEM

Despite the extensive fire control measures present in psychiatric hospitals, nearly all asylums have a history of at least one significant structural fire (Calder 2017; Jones 2017; Kelly 2001; McLean 1992; Nevins 1869; Scales 1914; Simpson 2012; *Wcl* 2022). This is surprising for two main reasons. First, the fire designs present in asylums were some of the most advanced in the world at the time. Professionals had no reason to believe their designs would be ineffective, let alone cause significant structural damage, collapse, and patient and staff injuries or death. But while renovations and laws were completed to increase hospital safety after asylum fires worldwide, many still lagged in their effectiveness.

For example, fires at the Colney Hatch and Seacliff Lunatic Asylums (discussed in more detail later) resulted in requiring renovations to add automatic fire alarms and sprinklers to the hospitals (Jones 2017; McLean 1992). However, changes were never implemented at either institution. Second, even if the state-of-the-art passive fire control methods were ineffective in fighting fires,

the on-site fire brigade (or other active fire control measures, if present) should have provided a second layer of defense by limiting a fire's severity before structural failure occurred. Unfortunately, this was not the reality for most asylums—some even experienced multiple significant fires throughout their histories (DeRucher 2022)

Though surprising, the overwhelming frequency of asylum fires throughout the 19th and 20th centuries is more easily understood by the methods from which they were designed, organized, and run. An examination of newspaper articles, hospital histories, and scholarly articles thus reveals three factors that contributed to fire start and spread, as well as structural failure and injuries and deaths among prominent psychiatric hospitals. This includes inadequate structural design; furnishings, fittings, active fire control; and the hospital patient and staff population. These factors and examples of each are discussed in more detail in the following sections.

## 1800s FIRE DESIGN STRATEGY

As mentioned earlier, most psychologists and superintendents agreed that any disaster or change in daily routine could exacerbate a patient's mental illness. This included the excitement of patients, disease spread, fire, and the like. As a result, architectural designs were primed to limit calamities in any way possible. For example, separate infirmaries were often constructed to prevent disease spread, and as mentioned, the most excitable patients were kept on the outskirts of Kirkbride buildings. To control fire, Kirkbride specified that an asylum "should be made as nearly fireproof as circumstances will permit" (Kirkbride 1854; Woolfe 2018). Therefore, various available fireproofing methods at the time were implemented.

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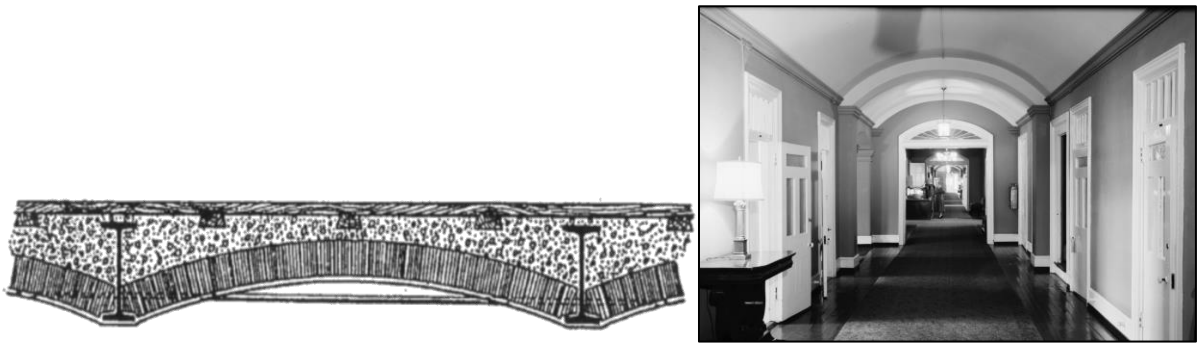
First, and most prominently, *structural* fire designs were implemented in nearly all American and British asylums by the rise of the Kirkbride Plan. Known today as *passive fire control*, these designs were effective because they required no system initiation (Spitzenberger et al. 2016). This included the stone or brick arched floor/ceiling combination as shown in **Figure 3** and the occasional metal fire door (Digital Exhibit: Fire at OSH! – OSH Museum 2012)**.** Both methods worked by compartmentalizing a space vertically (arched floor/ceiling) or horizontally (fire door) (*Smoke Guard* 2019).



a) b)

**Figure 3:** Structural fireproofing methods in 19th century asylums: Arched brick floor/ceiling combination, Pennsylvania Hospital for Mental and Nervous Diseases, a) structural drawing from 1899 (reprinted from Freitag 1899); b) finished view from 1958 (image by T. F. Dillon, courtesy of Library of Congress Prints and Photographs Division)

For example, if a fire broke out on the second floor of a psychiatric hospital, it would be prevented from spreading to the first or third floors utilizing the brick arches, while fire doors would prevent fire from spreading into nearby rooms or down the second-floor corridors. In addition, designers

integrated the separation of spaces within a building to minimize the spread rate of fire by limiting the two mechanisms from which it feeds, fuel and ventilation (*National Fire Protection Association* 2023). By reducing either or both mechanisms, the ability of a fire to expand in size and severity is also reduced.

Finally, passive fire control measures protect the integrity of structural members by limiting temperature rise in combustible materials. For example, the stone or brick of the arch combination can hold nearly double the amount of heat as the seasoned wood used for flooring (*Engineering Toolbox* 2003). Not only does this protect beams, columns, and other structural members (such as the iron floor beams in the arch combination) from premature collapse, but it also increases the amount of time available for people to safely evacuate a building before a fire reaches the point of instantaneous spread.

In all, passive fire control measures were rare, despite their common use in psychiatric hospital designs. This may be due to the high cost and low availability of construction materials during periods such as the Civil War in America (Troolin 2022). However, their high rate of inclusion in asylums may also be due to the relationship of state institutions with the governments that funded their construction. American and British governments were, in fact, some of the first entities to popularize the use of the brick arched floor/ceiling by including them in post offices, city halls, and other administrative buildings (Wermiel 1993). Regardless, the inclusion of passive fire designs in asylums provided a state-of-the-art quality never seen in buildings meant for the general population.

Passive fire control measures like those described above are perhaps less familiar than the fire alarms, sprinklers, and extinguishers typically used to fight fires today. Referred to as *active fire control* measures, these methods require some form of initiation to work (Spitzenberger et al. 2016). Active fire control methods were much less developed than passive measures during the height of psychiatric care, and therefore, they were less common in psychiatric hospitals. For example, the first modern sprinkler system was not developed until 1890 (Murphey 2019). Therefore, asylums constructed before this time simply did not include them. Furthermore, items developed earlier were not without their limitations. Asylums' typical active control measures were the *manual* fire alarm system box and *wooden* fire escape.

Despite discrepancies in active fire designs, hospital administrators were well aware of the high fire risk in their institutions. In fact, one of the commonly cited reasons for admittance to an asylum was a history of fire setting or pyromania (Andrews 2010). This directly resulted in the development of *asylum fire departments*. Often with their own personnel and hose house, the on-site fire brigade was the most prominent and effective example of active fire control on asylum grounds (Kowalick and Cataldo 2017). It allowed for swift action to combat fires rather than consulting the fire department in the nearest town, which could take hours.

## KEY CAUSES OF FIRES IN PSYCHIATRIC HOSPITALS

Psychiatric hospitals with detailed histories of fire start, spread, and consequences can be attributed to either one of the three contributing factors outlined above (inadequate structural design for fire, flammable furnishings, and active fire control, or the hospital population) or a combination thereof.

The following asylum fires most closely represent each of the categories and will be used to further explain each: the Central Ohio Lunatic Asylum fire (1868), the Longue Pointe Asylum fire (1890), the Dover Insane Asylum fire (1893), the Colney Hatch Asylum fire (1903), the Trans-Allegheny Lunatic Asylum fire (1935), the Seacliff Lunatic Asylum fire (1942), and the Highland Hospital fire (1948). While other asylums with a history of fire could be identified in newspaper articles, annual reports, or other documents, detailed information about the cause or effect of the fire was not available. Given the similarities between asylum superintendents, architecture, populations, and treatment methods, however, we believe that the presented discussion could serve as common ground for similar incidents.

*Inadequate Structural Design*

A categorization of inadequate structural design for fire hazards refers to a lack of knowledge of structural fire engineering and dynamics when designing asylums. For example, while brick fire arches and the use of incombustible materials were common in 19$^{th}$ and 20$^{th}$ century asylums, fire design was still an underdeveloped field. Both asylum architects and fire experts had little knowledge of fire effects on structural elements or fire spread (fuel and ventilation, temperature increase rates in various materials, etc.).

The above was compounded by the fact that the design of asylums was led by *medical professionals*. Thus, the "architecture as a cure" methodology made famous by Thomas Kirkbride and the Moral Era reformers was the most important aspect of the psychiatric hospital. One example of this can be seen in Kirkbride's *On the Construction, Organization, and General Arrangements of Hospitals for the Insane*, which specified that ceilings should be no less than

twelve feet high, corridors no less than twelve feet wide, and each door should have an open space above its header to aid in proper ventilation (Kirkbride 1854).

These designs, among many others, worked well to provide the maximum amount of fresh air and sunlight for patient treatments. However, the *open-concept* spaces also significantly increased the amount of oxygen available—one of the two factors that can increase fire severity. Furthermore, room openings essentially eliminated proper fire compartmentation. As a result, a fire could not be easily contained to its room of origin. Fires also spread structurally through asylums because of a lack of continuity of fire designs in building additions. Additions were made common in psychiatric hospitals by the end of the 19$^{th}$ century, primarily due to overcrowding of the original structure. Constructed of wood with corrugated iron, these secondary structures were only meant to be temporary (Jones 2017; R. E. Smith and Timberlake 2010).

However, a push from superintendents to bring in more paying customers and existing financial difficulties in most hospitals led to their long-term use as patient housing. With poor construction of combustible materials (wood), temporary structures had a much higher fire risk than the original asylum buildings made from stone-like materials. Furthermore, the thin iron sheets used for roofing and sheathing have high conductivity, making them susceptible to quick temperature increases (Nieuwmeijer 2001). As temperature rises in the metal, it loses its structural integrity (unlike the stone used for the original asylum structure) (Nieuwmeijer 2001). Thus, structural collapse was a new threat to temporary buildings if a fire occurred.

In addition, temporary buildings rarely included any fire control measures (passive or active), despite their common presence in the original asylum building. For example, the Seacliff Lunatic

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Asylum in New Zealand built a temporary structure to house 39 female patients in the early 1900s. This building had a manual fire alarm that could only be accessed by key and included no passive fire control measures, while the original stone structure had previously undergone updates to a new alarm system and was built with stone (Bundle, Tomlinson, and Laidlaw 1943). Unfortunately, the combination of poor structural design and a lack of fire control resulted in a fire in the temporary structure at Seacliff on December 8, 1942.

In this incident, 37 patients died due to smoke inhalation, and a later inquiry into the disaster noted both the inadequacy of the fire alarm system and the poor structural design of the building (Bundle, Tomlinson, and Laidlaw 1943; Simpson 2012). But while the temporary structure was reduced to ashes, the original asylum building was not significantly damaged, as shown in **Figure 4.** This can only be attributed to the difference between the wood and stone construction of each building, as mention of the asylum's fire brigade only stated their inability to control the blaze (*ASPire* 2016).

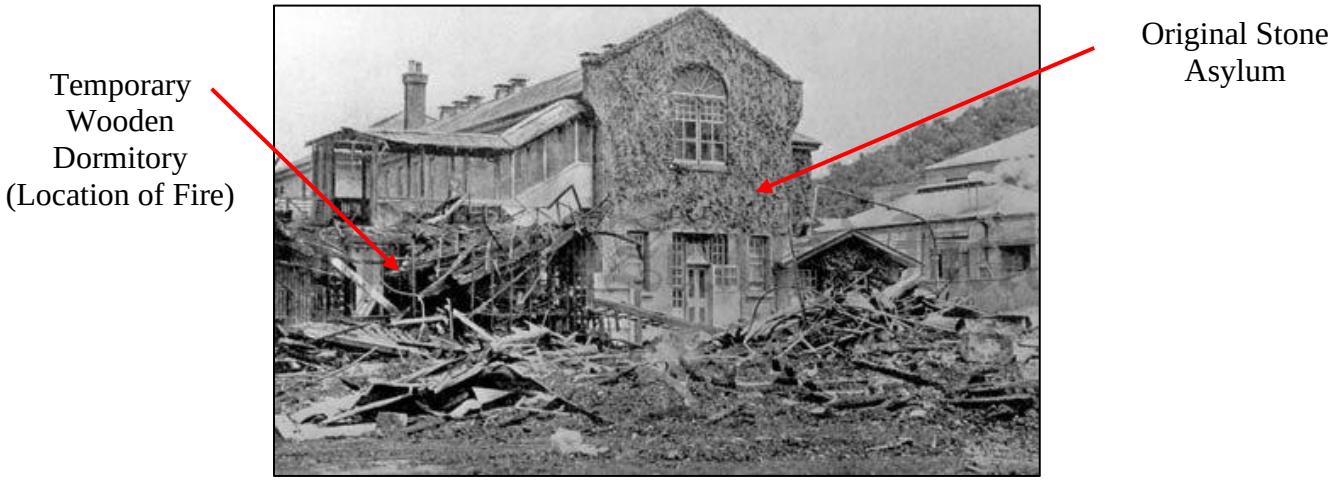


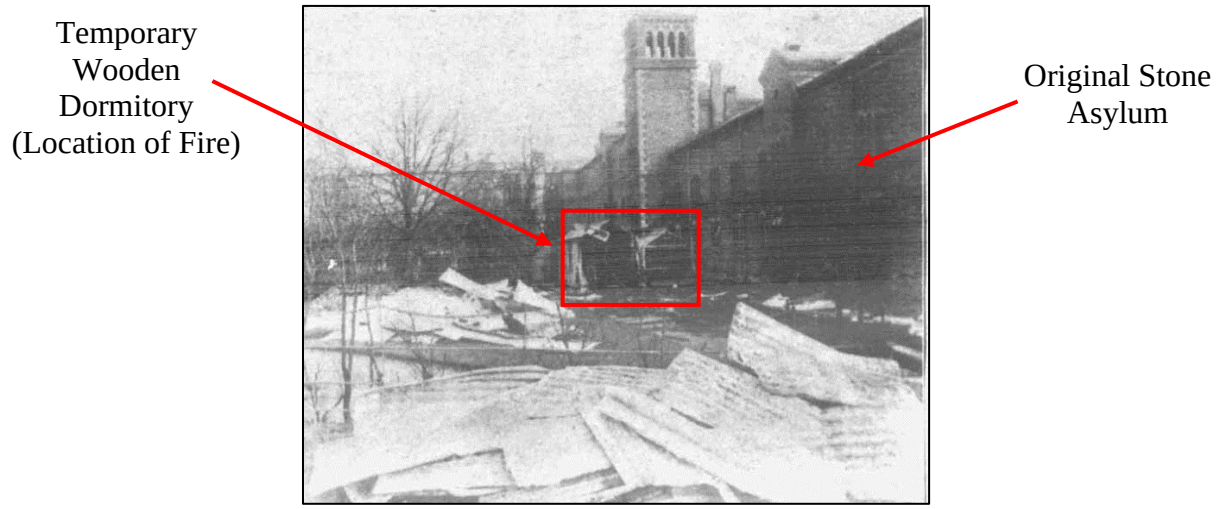

**Figure 4:** Comparison of Fire Damage at Seacliff Lunatic Asylum (*New Zealand History Online* 2020)

Seacliff was not the only institution to experience a deadly fire in poorly constructed buildings. Both the Colney Hatch Lunatic Asylum in London and the Dover Insane Asylum in New Hampshire also experienced fires. First, the Colney Hatch Lunatic Asylum fire occurred on January 27$^{th}$, 1903, in a temporary wooden structure. This building was previously identified by fire authorities as a significant fire risk due to its poor construction. Unfortunately, this warning went unheeded, and the fire destroyed the ward and caused the death of 50 out of its 300 residents (Jones 2017).

Second, the Dover Insane Asylum fire occurred in 1893. Located on the Strafford County Poor Farm, this asylum was converted from a farm building to a dormitory and later expanded to hold more patients (Scales 1914). It was constructed entirely of wood—sheathing, flooring, partitions, and furnishings—that was said to be so dry and shrunken that patients could see each other between the floors and rooms, despite only being 21 years old (Scales 1914). The dry wood exacerbated the fire's spread and ultimately resulted in the complete destruction of the building and the deaths of 41 of 44 patients (Scales 1914).

Each of the three previously mentioned asylum fires occurred directly due to their poor construction of fire-susceptible building materials and lack of passive fire control measures. However, their similarities do not stop there. The preservation of the original stone asylum can be identified in two of the three fires (the Dover Insane Asylum was a stand-alone building, not a temporary structure). Just as shown for Seacliff in **Figure 4**, a comparison of fire destruction between the temporary structure and the original building is shown for Colney Hatch in **Figure 5**. This is surprising given that the two fires occurred nearly 40 years apart and in vastly different

313 locations, but their similar construction again points to the stone as proper fire control in the
314 original asylum buildings. One can only assume that had stone been used for temporary structures,
315 the fires at Colney Hatch and Seacliff may have been more easily contained.




316

317 **Figure 5:** Comparison of fire damage at Colney Hatch Lunatic Asylum (*The Penny Illustrated*
318 *Paper* 1903)

319 Another similarity between these two incidents is that they all resulted in significant changes for
320 future asylums. First, following the fire at Seacliff, automatic fire alarms and sprinklers were
321 instructed to be installed in all portions of the asylum (as well as other asylums in New Zealand)
322 (Bundle, Tomlinson, and Laidlaw 1943). After Colney Hatch, temporary structures were abolished
323 in the U.K., and third, county asylums were abolished in the United States after the fire at Dover
324 (Jones 2017; Scales 1914).

325 Unfortunately, these measures took years to enact in most locations. For example, Seacliff installed
326 only minimal upgrades, later closing the asylum and moving the remaining patients to Cherry Farm

Hospital (McLean 1992; Simpson 2012). The reluctance to complete changes in all three countries after the devastating fires is likely a result of pushback from asylum superintendents and/or other stakeholders, including government officials. With already limited funding, they unlikely wished to spend the money on fire safety upgrades when it could be used for new treatment methods and equipment.

A final similarity between the sites is the poor construction of the original structure, even for the stone buildings of Seacliff and Colney Hatch. This note was previously mentioned for the Dover Insane Asylum, where dry wood resulted in visible building deficiencies. At Seacliff, structural problems were seen from the asylum's start. It was said to have been built on shifting sands that caused continuous foundation issues (*ASPire* 2016).

At Colney Hatch defects included separated walls and rafters, a collapsed arched ceiling (passive fire control measure), and insecure foundations and roof (*Friern Hospital* 2008). The defects at Dover and Colney Hatch were not the direct cause of their fires. However, it was likely the cause of Seacliff's. Sources note that, while the exact cause of the fire was never recorded, it was suspected to have been caused by an electrical short circuit as a result of the moving foundation (*ASPire* 2016). Thus, even if the disasters at Dover or Colney Hatch did not occur, their faulty construction would have been a probable cause for fire.

*Active Fire Control Methods, Furnishings, and Patient Safety Measures*

The second contributing factor to the overwhelming number of insane asylum fires includes the non-structural (active) fire control methods as well as the use of flammable hospital furniture and finishes.

The former—active fire control—is represented through fire alarms, sprinklers, and the on-site fire brigade. Often, fire alarms and sprinklers were not included in asylums. This may be due to reliance on passive control measures like the arched floor/ceiling. However, as previously noted, fire departments on hospital grounds were common. Not only did this lessen the importance of other fire control methods, but it also provided much quicker action than a nearby town's fire brigade could. Regardless of which type of active fire control was present in the asylum or on its grounds, they were each noted as contributing to a fire's spread and subsequent property loss, injuries and deaths in asylum fire reports.

The first example is from the Dover Insane Asylum, which had extensive active fire control for the time, such as a 200 feet rubber hose, a water tank with 20,000 gallons capacity, a spare 100 feet of hose, and four water pails on each of the first and second floors. The same asylum also had a manual fire alarm. Unfortunately, the investigation into the fire that destroyed the wooden building found that none of the available firefighting apparatus was used. Additionally, the fire alarm was not sounded because it was locked in a cabinet—just as at Seacliff *(Scales 1914; Seacliff Asylum Fire* 2022).

In other incidents, inadequate water supply for firefighting was noted as limiting the fire brigade's effectiveness (Michaels 2018). For example, this occurred at Colney Hatch, where firefighters were forced to create a dam across a nearby stream to fight the structure fire (Holzwarth 2018). If active fire control measures had been properly supplied and used at Colney Hatch, Seacliff, and Dover, the fires would have been extinguished more readily.

More commonly seen in the histories of asylums are contributions from flammable furniture and fittings to fires. At the time, furniture was chosen to create a homelike environment in the asylum (Boult 2017). Thick rugs, curtains, wooden storage units, and bedding were common, and wealthy patients were allowed to bring their own furniture. In addition, wainscoting and gas lamps were customary (*Science Museum* 2020; Schwartz 2021). Some examples of these items can be seen in **Figure 6**, which shows two different asylum interiors.

a) b)

**Figure 6:** a) Ward at Department for Women, 1900 (image courtesy of United States National Library of Medicine); b) Ward for men in an unidentified mental hospital in Britain [reprinted from Wellcome Collection under Creative Commons-BY-4.0 international license https://creativecommons.org/licenses/by/4.0/)].

Unfortunately, these materials were highly flammable and quickly contributed to asylum fires. The first example, including flammable furnishings, is from Highland Hospital in North Carolina. On March 10, 1948, a fire was discovered in the kitchen by nurse Doris Jane Anderson (Calder 2017).

She later described the flames as "one of those fiery hoops animals jump through in circuses" and noted that she did not put out the fire because she had never witnessed such a "destroying" event (Calder 2017). This fire spread with the help of an improperly lined dumbwaiter shaft; instead of being constructed with metal lining, it was covered with plaster and mason board (Calder 2017). As a result of the fire, nine women died, including famed author F. Scott Fitzgerald's wife, Zelda Sayre Fitzgerald (Calder 2017).

The second example of a fire resulting from flammable finishings is from the Central Ohio Lunatic Asylum. Occurring in 1868, this asylum fire was the result of a patient lighting a combustible material (likely clothing) with the building's gas lights (Nevins 1869). The fire was accelerated with the help of an empty attic and insufficient water supply. Later, the asylum was rebuilt using the Kirkbride Plan, referred to in the local newspaper as the "fireproof" plan (*The New York Times* 1868).

The third cause to be discussed herein includes patient safety measures. Bars on windows, locked doors, and even wooden fire escape all contributed to patient deaths in various asylum fires. This is an interesting common occurrence in the history of asylums given the measures' original intentions of protecting patients from their own mental illness—bars on windows kept people from jumping, locked doors prevented mischief and wandering, and the fire escapes were supposed to allow self-evacuation. But while these measures kept patients safe during typical operations, they quickly transformed into death traps during fires.

For example, there are multiple examples of locked wards preventing escape during asylum fires. This occurred at Seacliff, Highland Hospital, and Central Ohio (Calder 2017; *Fire at Seacliff* 2023;

Gustafson 1868). Similarly, barred windows prevented self-evacuation as well as the possibility of retrieving help from the fire brigade. This was noted in an *Asheville Citizen* article following the Highland Hospital fire, which stated that firemen were haampered in their rescue by "windows (were) shackled with chains as a precautionary measure to keep patients from jumping out" (Calder 2017). Interestingly, this article also mentioned the hospital's screened porches as preventing rescue efforts. These were dually noted as the primary fire escapes for the facility, but they were constructed entirely of wood (Hardee and Hardee Milling 2018). Unfortunately, this facilitated the spread of the Highland fire vertically with the dumbwaiter shaft and resulted in 9 deaths (including Zelda Fitzgerald) of patients kept on the fifth floor of the building (A. Smith 2022).

*The Hospital Melting Pot*

The final contributing factor to asylum fires in the 19$^{th}$ and 20$^{th}$ centuries is the wide range of hospital patients and staff. The first group of patients suffers from pyromania. This is likely one of the reasons they were constantly confined behind locked doors and barred windows. Despite such confinement, this did not fully prevent them from starting fires. The first example of this is from the Trans-Allegheny Lunatic Asylum. A Kirkbride building, this asylum operated from 1864 to 1994. By 1938, the hospital held more than 2,000 patients, making them hard to supervise and manage. Just three years earlier, a fire occurred on the unoccupied fourth floor of the south wing**.** As a result, six wards were destroyed by fire and water, the roof was badly damaged, and a cupola collapsed. Later it was discovered that the fire was started by an 18-year-old patient who was left unsupervised on the fourth floor. This patient lit some papers on fire, became frightened, and then left the wing without telling anyone (Jacks 2008).

In addition to patients *starting* fires, they also regularly contributed to poor evacuation and fire spread as well. Several reports have noted patient panic and excitement. For example, the Longue Pointe Lunatic Asylum experienced a fire in 1890. It is unclear how the fire started, but there is an account of what happened following the fire's discovery. First, the fire alarm was sounded by one of the nurses. Upon the fire department's arrival, efforts were quickly turned to saving patients, as the building was already engulfed in flames. Unfortunately, it was noted that some of the patients turned violent and even refused to leave the burning building, which hampered further rescue efforts (Wilkins 2012).

A similar scene occurred at Colney Hatch, where the fire brigade had difficulty in making patients understand the danger of the fire. Many refused to evacuate, and a newspaper article in *The Mercury* even noted that "some of the patients, evading the nurses, roamed through the Asylum grounds in night attire until daylight" (*The Mercury* 1903).

Fire starting by patients, though alarming, is much less surprising than hospital staff's common contributions to asylum fires. The hospital staff has been commonly cited in fire reports and newspaper articles, from improper fire training to poor supervision and a lack of understanding of asylum patients. At Dover, for example, there were extensive active control measures. Despite this, the night watchman who discovered the fire was unaware of the fire hose location, and thus, it was never used (Scales 1914). In addition, the fire at Dover was started by patient Mary La Fontaine with a match given to her by one of the watch guards (Scales 1914).

This combination of incidents indicates a lack of staff training and their poor understanding and inability to care for patients. Furthermore, overcrowding and increasing asylums led to a high

patient-to-staff ratio spread out over large areas. In many cases, this resulted in few checks onwards throughout the day. Not only did this give patients a greater opportunity to start fires (like Trans-Allegheny), but it also allowed time for fire development. For instance, at Seacliff, for example, ward checks were completed only once an hour. By the time the fire at the institution was discovered, the temporary was already fully engulfed in flames (*New Zealand History Online* 2020). In all, little could be done to reduce the fire risk for patients with a fire-setting history or similar mental illness diagnoses. However, proper training, discipline, and more frequent ward checks would most certainly have reduced the number of fires in 19$^{th}$ and 20$^{th}$ century insane asylums.

## ADAPTIVE RE-USE AND CONTINUED FIRE SAFETY RISKS

With the increasing cost of un-used land and construction materials as well as the push for sustainable development, many architects, designers, and owners have looked to repurpose historic buildings rather than build new in recent years. Termed “adaptive re-use”, this process looks to retrofit old buildings for new uses—thus changing the intent of a structure to meet modern needs (Clark 2008). Benefits of adaptive re-use include the retainment of historic charm and character as well as a commonly lower price tag (as opposed to new-construction) and a reduction in environmental damage (Clark 2008).

By the 1960s, issues such as fire, lack of workforce, poor patient treatment, and structural deficiencies in many psychiatric hospitals reached a boiling point. As a result, many Kirkbride and Cottage Plan hospitals were defunded and abandoned in a movement away from organized mental health care called *deinstitutionalization* (Allen, Hall, and Rosenberg 2019). The large footprints

and grand architectural designs of those that remained standing made them seemingly perfect candidates for adaptive re-use. Thus, several were converted into modern hospitals, museums, apartment buildings, and much more. In fact, the Trans-Allegheny and Seacliff hospitals were each converted to museums following their use as asylums (though nothing now remains of the Seacliff site) (Benson 2007; Trans-Allegheny Lunatic Asylum 2023). Additionally, Colney Hatch remained in operation as a modern hospital until 1993, when it was converted to residential housing (still in use today) (Friern Hospital 2008).

Despite the benefits of converting such psychiatric sites for modern use, however, issues of fire safety and mitigation remain a prominent concern. First, structural aspects and/or layouts of historic buildings are often protected from removal or modification under *heritage protection* to preserve the original identity of a structure (Kincaid 2022). While this helps to retain the history and character of the original architecture, it also often forgoes the ability to sufficiently update the *structural*, or passive, fire control measures of the building.

For example, the arched brick ceiling of the Colney Hatch Lunatic Asylum—now apartments—has been preserved. While this structural element was one of the most premier passive fire control methods used in Kirkbride era hospitals, it is now far outdated for use as proper compartmentation of the building. This is mainly due to the increased fire loads of modern construction materials, furniture, and electrical items which burn faster and at higher heat than inclusions of the 19$^{th}$ and 20$^{th}$ centuries (Why Do Modern Construction Materials Burn Faster? 2016). As a result, a fire in the converted building would now pose a more significant threat to spread beyond its compartment and cause structural failure. Other examples of preserved elements in psychiatric hospitals may

include long corridors, open floor plans, and wall paneling—posing increased fire threats due to lack of compartmentation and flammable materials.

Second, construction to convert the existing building for new use also poses a fire threat (Kincaid 2022). While this is also the case for new construction, such buildings typically have fire control measures included during the construction phase. On the other hand, historic buildings such as asylums which were often constructed with crude passive and no active fire control, do not have such inclusions. In addition, existing compartmentation may be compromised during the construction phase, and combustible materials are often stored on-site. This makes historic psychiatric hospitals particularly vulnerable, provided their already limited compartmentation. Common "hot work" practices (welding, for example) that include heat-producing equipment increases fire risk as well (Kincaid 2022). This can include stone-cutting, since the process may produce sparks (Kincaid 2022). Given the stone façade of many asylums, including Colney Hatch shown below, the replacement and repair work required to maintain proper upkeep and structural integrity of the building can in itself pose a significant fire concern.

**Figure 7:** Stone Façade of Colney Hatch Lunatic Asylum (Friern Hospital 2017)

Finally, the conversion of historic psychiatric hospitals away from residential care facilities and toward commercial use may also pose a new fire threat. This is primarily due to increased technological and electrical needs of modern facilities for large populations. For example, both Seacliff (though temporary) and the Trans-Allegheny Lunatic Asylum were converted to museums in an attempt to preserve the history and legacy of their respective institutions. Such visitor attractions commonly require the inclusion of large commercial-grade kitchens and other electrical needs (spotlights, safety lighting, etc.) not accounted for by the original property. As such, additional fire loads are brought into the space and may result in kitchen or electrical fire, two commonly stated causes of historical building fires (Kincaid 2022). In addition, Colney Hatch Lunatic Asylum was converted to a non-pschiatric hospital until 1993. Similar to the electrical and appliance needs of the converted museums, the modern hospital also requires modern technological, electrical, and medical needs (i.e., x-ray, oxygen, lighting, sanitation, etc.) that were not required of the psychiatric hospital. Such items pose electrical fire threats and include combustible materials or gases that can compromise the integrity of the building in the event of a fire.

## CONCLUSIONS

Psychiatric hospitals were plagued with overcrowding and financial struggles that made it difficult to afford high-quality fire safety measures and an adequate number of staff. As a result, little could be done to prevent the astounding number of asylum fires that occurred within hospital walls during the 19$^{th}$ and 20$^{th}$ centuries. This paper recounted the histories of seven prominent asylums

around the world—all of which suffered from at least one significant fire. The subsequent gathering of reports on these fires concluded that asylum fires were caused by three main entities: inadequate structural design, furnishings and active fire control, and the unique mixture of hospital population. Within these categories, common themes included the improper design of temporary buildings, a lack of active fire control measures, poor water supply for firefighting, and improper training of staff and patients for fire evacuation.

While we can no longer change the property damage and loss of life that resulted from the fires, a number of possible changes could have prevented such fires from happening. First, temporary wards were frequently cited as fire risks within asylums (*Friern Hospital* 2008; Jones 2017). Had they been constructed with proper passive fire control within the main building (stone and brick arches), a fire would have been more easily contained. This was clearly seen through the comparison of damage at Seacliff and Colney Hatch, where both temporary wards were destroyed by fire, but little damage was sustained by the original stone buildings.

Second, safety training for staff (fire or otherwise) seemed lacking within asylums. Knowledge about the location of firefighting equipment or even supervision of at-risk patients would have drastically reduced fire spread. Unfortunately, this was unlikely due to the lack of staff in times of war and at overcrowded hospitals. Finally, improper water supply was a significant factor in at least two asylum fires (Colney Hatch and Central Ohio).

While fire hydrants had been in use since the early 1800s, an asylum's location away from the city made them a rare inclusion at hospitals (Jackson 1944). Thus, large tanks kept on the top floors of asylums were often the only source of water. As a result, they were used not only to fight fires, but

546 also to cook, clean, and drink. With a proper, separate supply kept for the fire brigade, perhaps
547 they could have sufficiently extinguished many of the fires they fought.

548 Overall, many unique factors contributed to asylum fires. While they were a devastating piece of
549 the history of mental health, their legacy continues through the positive changes enacted:
550 temporary structures were abolished, sprinklers and automatic fire alarms were standardized, and
551 patients were more adequately cared for. In addition, several have been converted through adaptive
552 re-use to give new life to the extraordinary architecture of the Kirkbride and Cottage Plan asylums.

553 **Data Availability**

554 Some or all data, models, or code that support the findings of this study are available from the
555 corresponding author upon reasonable request.

556 **Conflict of Interest**

557 The authors declare no conflict of interest.

558 **Image Use**

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560 domain. All sources are credited appropriately. No images were modified other than the indicators
561 and text in figures 4, and 5.

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