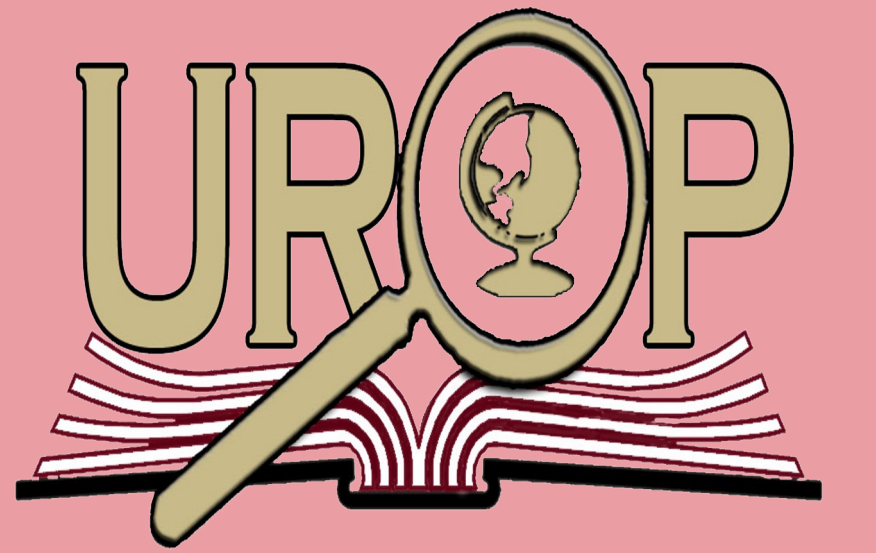




A REVIEW OF FLOOD IMPACTS ON HUMAN RESPIRATORY HEALTH



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Background

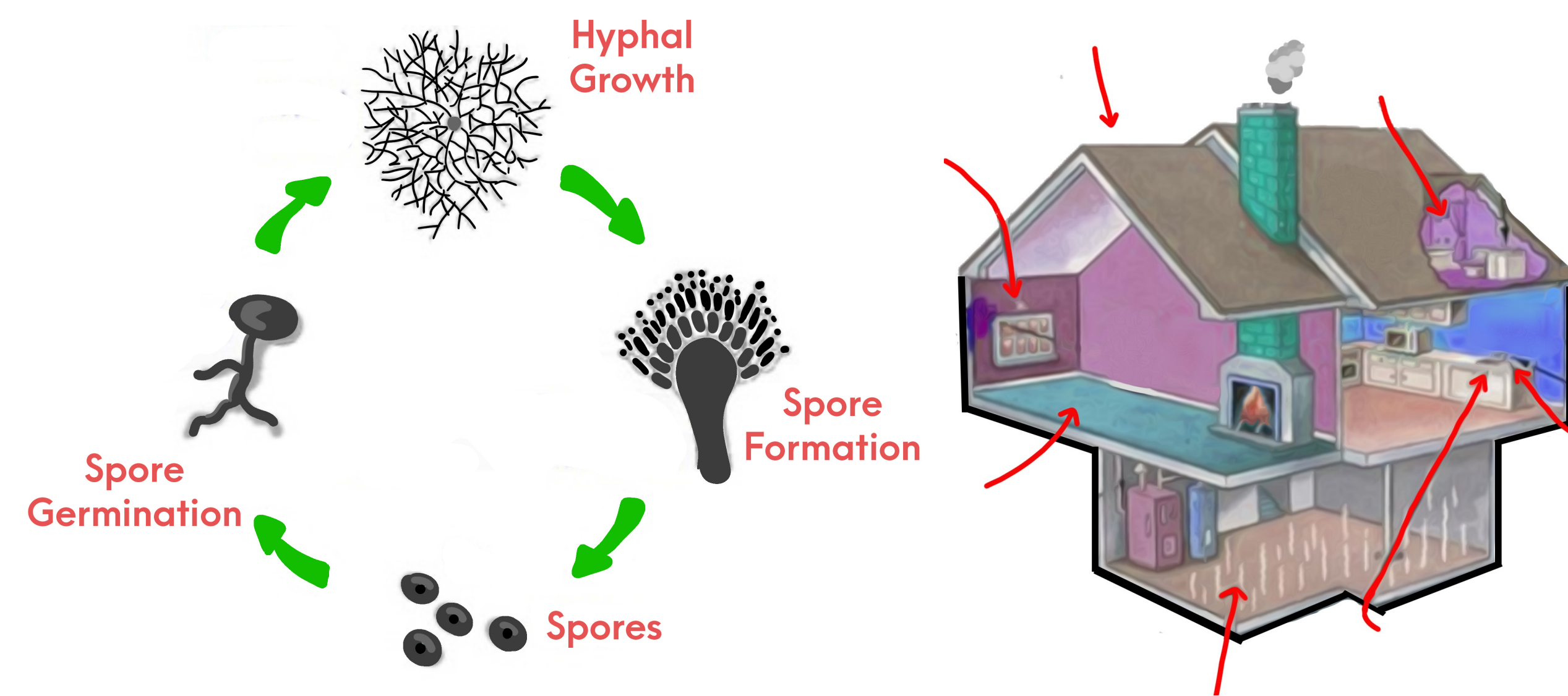


Chart 1. ***Mold Cycle information gathered from Jun Moon 2005***

Mold Stage	Time Elapsed	Visible?
Hyphal Growth	0-7 days	No
Spore Formation	5-7 Days	No
Spore Dispersal	7-10 days	No
Spore Germination	10-12 days	No
Spore Germination	16-	No
Spore Germination	21-28+ days	Yes, in accessible areas w/ contrasting background
Continues		

Chart 1. shows that mold is non-visible for relatively long periods while potentially producing mycotoxins that negatively impact human respiratory health

Methods

Key words and Search Engines

“Flood*” AND “Health*” AND “Mold*” OR “Fung*” appearing more than once in study were used to create Table 2
Google Scholar, Web of Science, PubMed

Limits

- English peer reviewed journals
- Date of publication from 2000-2021

Additional

- 144 studies were selected with relevance to flooding and human health effects, 26 of these studies met the key words criteria, 6 of said studies were selected for Table 1. and Table 2. based on significance

Results

Table 1. Flood impacts on mold

Study	Study Design	Flood and Building	Findings
Sylvain et al. 2019	A sampling of airborne fungi from dust settled over a month-long time period from the outdoors, in units with no visible mold, and units with visible mold of 21 household were collected	San Francisco Bay Area long term flood damaged concrete building named inhabitable (2014)	No difference in biomass was recorded between visible and non-visible mold. Samples of non-visible mold had greater richness and diversity than samples of visible mold. <i>Note:</i> Samples of visible mold collected by swab also collected samples of non-visible mold with low distinguishing rate.
Emerson et al., 2015	Air samples were collected 2-3 months after flooding and remediation had occurred. The abundance of fungi in flooded and non flooded homes was calculated	Colorado, USA flooding (2013) in 50 residential home basements	Three times higher fungal abundance in flooded, relative to non-flooded homes after remediation and return of baseline humidity. <i>Note:</i> Reason why fungi persists after unclear remediation process is not stated despite humidity not playing a major role.
He et al., 2014	Indoor and outdoor measurements of fungi were conducted 2 and 6 months after the flood in 41 residential houses	Brisbane, Australia flooding (2011) in brick or wooden residential houses	This study suggest that there were no effects of the flood in Brisbane on indoor air quality , in terms of PM10, PN, fungi and bacteria concentrations. <i>Note:</i> Despite the mention of immediate volunteer work as remediation, the specific remediation process is not stated.

Table 2. Flood impacts on respiratory health

Study	Study Design	Flood and Participants	Findings
Kontoyiannis et al. 2019	Mold-positive culture infections(IMI) in 12-month period before and after hurricane Harvey were compared	Hurricane Harvey Flooding (2017) Immunosuppressed patients of MD Anderson Cancer Center (MDACC)	no excess cases of IMIs in MDACC's immunosuppressed patient population after flooding event were found. However, an increased use of mold-active antifungals after flooding was observed institutionally for reasons unclear. <i>Note:</i> Only the results of immunocompromised individuals were examined (may be more cautious to fungal exposure)
Nguyen et al. 2019	Statistical analysis and questionnaire was used to compare the respiratory health of a pre and post hurricane population	Hurricane sandy(2012) flooding, New Jersey General population in high impact and low impact areas	The post hurricane group showed higher percentages of people who reported poor perceived general health and a higher percentage of people who were given an asthma action plan <i>Note:</i> The exposure to mold for the participants tested was not examined
Saporta et al. 2017	200 total participants were tested (100 participants from 2003-2010 and 100 from 2014-2015) with 18 molds to test their reactivity pre and post hurricanes	Hurricane Irene(2011) and Hurricane Sandy(2012)	An increase in positive test results shows that the post hurricane population had become more sensitized and reactive to the same molds affecting respiratory health <i>Note:</i> The exposure to mold for the participants tested was not examined

Conclusions

- Large floods like hurricanes have been the sole focus of past research
- There has been a growing interest in this research area over the past five years
- There is an ongoing trend between recent studies and research conducted specifically on respiratory health as seen
- The data collected will give us knowledge on how to address these trends to take progressive action in the remediation of affected homes and avoid negative respiratory health effects.

Future Research

- A questionnaire can be conducted on flood affected homeowners to aid us in understanding the perspective of homeowners on the formation of mold they may deem “not dangerous”.
- Home inspections may be conducted to correlate the mold exposure of residents of an affected area to respiratory complications caused by specific mold species
- The correlation between mold growth due to flooding and adverse health effects will provide answers to how remediation can be conducted to prevent said respiratory illness

References

- Emerson et al., (2015) Impacts of Flood Damage on Airborne Bacteria and Fungi in Homes after the 2013 Colorado Front Range Flood
- He et al., (2014) The impact of flood and post-flood cleaning on airborne microbiological and particle contamination in residential houses
- Kontoyiannis et al. (2019) Culture-Documented Invasive Mold Infections at MD Anderson Cancer Center in Houston, Texas, Pre- and Post-Hurricane Harvey
- Moon, H. J. (2005) Assessing Mold Risks in Buildings under Uncertainty
- Nguyen et al. (2019) Asthma-Related Health Outcomes in New Jersey after a Natural Disaster Event
- Saporta et al. (2017) Increased Sensitization to Mold Allergens Measured by Intradermal Skin Testing following Hurricanes
- Sylvain et al. (2019) A different suite: The assemblage of distinct fungal communities in water-damaged units of a poorly maintained public housing building