Hydro-Thermal Therapies are Essential for Building Health, Safety and Resilience in the Age of Pandemics

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Introduction

This paper provides evidence to support the classification of hydro-thermal facilities as 'essential services'. Hydro-thermal therapies such as hot baths, cold plunges, saunas, steam-baths and mud-wraps improve public health, reduce the risk of chronic disease and boost the immune system's ability to resist viral infections. Hydro-thermal therapies also confer psychological benefits and improve sleep, relieve stress, and foster interpersonal connection and connection with nature.

Hydrothermal facilities such as saunas, which operate at temperatures that destroy viruses, provide safe havens from respiratory viruses and are safe places to visit during a pandemic. Treating hydro-thermal therapies as essential services will bolster public health and immune tolerance and counter the many detrimental physical, mental, social and economic impacts of the current pandemic.

Education of operators and implementation of preventive measures that include infection control measures along with appropriate disinfection, sanitation and water quality monitoring, are critical to the successful re-integrating of hydro-thermal facilities into society. Ultimately, governments and communities need to support optimal immune function and work toward the long-term goal of building community resilience. Whether in a public spa facility or at home, maintaining hydro-thermal therapies can boost our collective immune systems and help us all, today and in the future.

1) Hydro-thermal Therapies Can Enhance Health and Wellbeing and Help Treat and Prevent Viral Infections

- The benefits of hydrothermal therapies have been known for thousands of years and have been shown to be effective for disease prevention and health promotion [1-3].
- Hydrothermal therapies such as saunas, steam rooms, hot baths, balneotherapy, pelotherapy etc are backed by historical, epidemiological, anecdotal, clinical and randomized controlled-trial evidence that attest to their safety and efficacy[4].
- Hydrothermal therapies induce a hormetic stress response that builds resilience and resistance to pathogens and harmful exogenous stimuli.
- There is evidence to show hydro-thermal therapies such as bathing [5], balneotherapy [6], sauna bathing [7], massage [8] and healing touch [9] are safe and effective in the treatment and prevention of many chronic diseases [10].
- Hydrothermal therapies provide cheap, effective and widely available disease-prevention strategies that can be used in homes and integrated into conventional healthcare services, aged care centres and other community facilities.

2) Hydrothermal Therapies Inhibit Viral Virulence

- SAR-Cov-2 is an enveloped RNA virus with a lipid envelope that is sensitive to heat and is destroyed by UV light and temperatures over 55^{o}C [11-16].
- SAR-Cov-2 must be introduced through mucosal surfaces to gain entry into cells with ACE-2 receptors and cannot reproduce in water and cannot be transmitted via direct skin contact. There is no evidence that COVID-19 can spread to people through water used in pools, hot tubs, or water playgrounds."[17]
- Enveloped viruses such as coronaviruses are most active in cool dry conditions, which are associated with increased occurrence of respiratory tract infections [18], including infections with SARS-CoV [19] and SAR-CoV-2 [20, 21].
- Warm humid environments reduce airborne droplet spread inhibit transmission of respiratory viruses and humidity of around 50% leads to slower infection and less severe illness [22]
- Air quality is enhanced at hot springs and thermal water inhalation is able to modulate and enhance systemic immune responses [23].

3) Hydrothermal Bathing Supports Host Resistance

- Humans can happily tolerate temperatures that destroy coronaviruses and such temperatures are found in saunas which typically have ambient air above >70^{o}C.
- Raising body temperature through exposure to external heat is an evolutionary strategy that has been preserved for over 600 million years and is used by fish insects, reptiles, birds, and mammals for controlling viral infections [24].
- There is extensive evolutionary, historical, epidemiological, physiological, psychological and clinical evidence supporting the use of heat to treat respiratory viruses as well as treat and prevent other infections and chronic diseases [25].
- Warm humid environments support naso-ciliary clearance, which serves as the immune system's first line of defence against viral respiratory pathogens by trapping viruses, presenting them to the immune system so antibodies can be produced, and then disposing of them before they can cause illness [26].
- Recent evidence shows balneotherapy and aquatic therapy improves respiratory function and helps prevent and treat respiratory diseases [27, 28].

4) Hydrothermal Therapies Build Community Resilience

- Bathing is essential for good health and investments in clean water initiatives that provide access to optimum bathing facilities support individual, community and global health.
- Regular heat-based treatments such as saunas, steam rooms, hot spring bathing, hot mud wraps, etc., build physiological and psychological resilience and lead to lower overall morbidity and mortality.
- Hydrothermal treatments provide psychological benefits that are difficult to overstate. These benefits can help overcome the trauma and feelings of helplessness from forced confinement and uncertain economic and social circumstances, and include improved sleep, reduction of stress and anxiety, connection with nature and social connection [29-31].

- Staff, guests and local communities require reassurance, communication and education on cleaning protocols and hygiene measures, and special facilities or procedures are required to protect people who are sick, immuno-compromised, or more vulnerable to infection. Education is also required on how hydrothermal treatments can be done at home using hot baths or showers in conjunction with cold showers or foot baths.
- Supporting hydrothermal bathing as a regular lifestyle activity builds community resilience, provides medical personnel with respite, and contributes to culture of wellness that can mitigate the impact of current and future pandemics.

5) Preventative Measures for Operators

- Education of operators and implementation of preventive measures that include infection control, sanitation and microbial monitoring and management are critical for the successful re-integration of hydro-thermal facilities into society.
- Maintaining optimal air quality by minimising pollution, smoke and volatile disinfection by-products, keeping temperatures between 20-25 degrees and relative humidity between 40 and 60%, are effective measures to enhance naso-ciliary clearance, minimise aerosol spread, and reduce the chance of infection for staff and guests.
- The best way to protect staff and guests is to encourage personal health and hygiene practices that include healthy beverages, good sleep and nutrition, exposure to sunlight, minimal stress and anxiety, and regular hot and cold experiences where available. Hydro-thermal therapies may be particularly useful to provide respite and build the resilience to infection for staff working in conventional medical facilities.
- Gloves are not required for touch-based treatments. Gloves reduce the quality of the experience for both therapist and guests and reduce the therapeutic exchange provided by physical human touch, which operates on many levels and has a direct stimulatory effect on the immune system.
- Specific research is needed on the ability of heat-based interventions to prevent and treat COVID-19. Such research could be conducted at hydro-thermal facilities through online clinical trial and citizen science platforms that monitor guest health.

Common Sense Safety Principles

Heat is a powerful force and like any powerful intervention, has the potential to either harm or help. Common sense safety precautions when using heat include;

- **Drink**: Ensure your stay hydrated with a good quality water.
- **Take care**: Avoid burns or scalds near sources of heat and sudden changes in posture that could lead to dizziness or fainting;
- **Know your limits**: Heat tolerance varies widely between individuals and within the same individual at different times. Use your comfort level as a guide to exposure and don't go beyond the point of being 'comfortably uncomfortable'.
- **Be aware**: Tune into your senses, monitor your tolerance and enjoy heat-induced 'forced mindfulness'. Avoid extremes of temperature when under the influence of alcohol or drugs that impair your judgement;
- **Rest**: Alternate exposure to hot or cold with relaxation and re-balancing periods. Spend at least as much time resting and coming back into physiological balance as you spend in extremes of temperature.

REFERENCES

1. Galvez, I., S. Torres-Piles, and E. Ortega-Rincon, *Balneotherapy, Immune System, and Stress Response: A Hormetic Strategy?* Int J Mol Sci, 2018. **19**(6).
2. Agishi, Y., *Clinical Usefulness of Long-Term Thermohydrotherapy (Balneotherapy)*, in *Thermotherapy for Neoplasia, Inflammation, and Pain*, M. Kosaka, et al., Editors. 2001, Springer Japan: Tokyo. p. 486-494.
3. Nasermoaddeli, A. and S. Kagamimori, *Balneotherapy in medicine: A review.* Environmental health and preventive medicine, 2005. **10**(4): p. 171-179.
4. *Hyperthermia in Humans Enhances Interferon-γ Synthesis and Alters the Peripheral Lymphocyte Population.* Journal of Interferon Research, 1988. **8**(2): p. 143-150.
5. An, J., I. Lee, and Y. Yi, *The Thermal Effects of Water Immersion on Health Outcomes: An Integrative Review.* Int J Environ Res Public Health, 2019. **16**(7).
6. Antonelli, M. and D. Donelli, *Effects of balneotherapy and spa therapy on levels of cortisol as a stress biomarker: a systematic review.* International Journal of Biometeorology, 2018. **62**(6): p. 913-924.
7. Hussain, J. and M. Cohen, *Clinical Effects of Regular Dry Sauna Bathing: A Systematic Review.* Evid Based Complement Alternat Med, 2018. **2018**: p. 1857413.
8. Ng Kenny, C., M. , *The Effectiveness of Massage Therapy A Summary of Evidence Based Research* 2012, Australian Association of Massage Therapists Melbourne Australia.
9. Wardell, D.W. and K.F. Weymouth, *Review of studies of healing touch.* J Nurs Scholarsh, 2004. **36**(2): p. 147-54.
10. Bender, T., et al., *Evidence-based hydro- and balneotherapy in Hungary--a systematic review and meta-analysis.* Int J Biometeorol, 2014. **58**(3): p. 311-23.
11. Lelie, P.N., H.W. Reesink, and C.J. Lucas, *Inactivation of 12 viruses by heating steps applied during manufacture of a hepatitis B vaccine.* J Med Virol, 1987. **23**(3): p. 297-301.
12. Hu, L., et al., *Biophysical characterization and conformational stability of Ebola and Marburg virus-like particles.* J Pharm Sci, 2011. **100**(12): p. 5156-73.
13. Duan, S.M., et al., *Stability of SARS coronavirus in human specimens and environment and its sensitivity to heating and UV irradiation.* Biomed Environ Sci, 2003. **16**(3): p. 246-55.
14. WHO Report, *First data on stability and resistance of SARS coronavirus compiled by members of WHO laboratory network*. 2003, WHO Multi-center Collaborative Network on SARS Diagnosis.
15. Darnell, M.E.R., et al., *Inactivation of the coronavirus that induces severe acute respiratory syndrome, SARS-CoV.* Journal of Virological Methods, 2004. **121**(1): p. 85-91.
16. Kampf, G., A. Voss, and S. Scheithauer, *Inactivation of coronaviruses by heat.* Journal of Hospital Infection, 2020.
17. Centres For Disease Control, *COVIDView (May 1st)*. 2020, Centres For Disease Control.
18. Makinen, T.M., et al., *Cold temperature and low humidity are associated with increased occurrence of respiratory tract infections.* Respir Med, 2009. **103**(3): p. 456-62.

19. Chan, K.H., et al., *The Effects of Temperature and Relative Humidity on the Viability of the SARS Coronavirus.* Adv Virol, 2011. **2011**: p. 734690.
20. Wang, J., Tang, K., Feng, K., Lv, W., *High Temperature and High Humidity Reduce the Transmission of COVID-19* 2020.
21. Sajadi, M.M., Habibzadeh, P., Vintzeleos, A., Shokouhi, S., Miralles-Wilhellm, F., Amosroso, A., *Temperature and Latitude Analysis to Predict Potential Spread and Seasonality for COVID-19*. 2020: http://dx.doi.org/10.2139/ssrn.3550308
22. Kudo, E., et al., *Low ambient humidity impairs barrier function and innate resistance against influenza infection.* Proceedings of the National Academy of Sciences, 2019. **116**(22): p. 10905-10910.
23. Magrone, T., et al., *Effects of thermal water inhalation in chronic upper respiratory tract infections in elderly and young patients.* Immunity & ageing : I & A, 2016. **13**: p. 18-18.
24. Evans, S.S., E.A. Repasky, and D.T. Fisher, *Fever and the thermal regulation of immunity: the immune system feels the heat.* Nat Rev Immunol, 2015. **15**(6): p. 335-49.
25. Cohen, M., *Turning up the heat on COVID-19: heat as a therapeutic intervention [version 2; peer review: 2 approved].* F1000Research, 2020. **9**(292).
26. Fahy, J.V. and B.F. Dickey, *Airway mucus function and dysfunction.* The New England journal of medicine, 2010. **363**(23): p. 2233-2247.
27. Choukroun, M.L., C. Kays, and P. Varene, *Effects of water temperature on pulmonary volumes in immersed human subjects.* Respir Physiol, 1989. **75**(3): p. 255-65.
28. Karampitsakos, T., Dimakou, K., & Bouros, D.,, *Role of aquatic therapy and speleotherapy as complementary therapies in the respiratory system.* Pneumon, 2016. **29**: p. 269-273.
29. Clark-Kennedy, J. and M. Cohen, *Indulgence or therapy? Exploring the characteristics, motivations and experiences of hot springs bathers in Victoria, Australia.* Asia Pacific Journal of Tourism Research, 2017. **22**(5): p. 501-511.
30. Rapoliene, L., A. Razbadauskas, and A. Jurgelenas, *The reduction of distress using therapeutic geothermal water procedures in a randomized controlled clinical trial.* Adv Prev Med, 2015. **2015**: p. 749417.
31. Dubois, O., et al., *Balneotherapy versus paroxetine in the treatment of generalized anxiety disorder.* Complement Ther Med, 2010. **18**(1): p. 1-7.