Healthy HEATING

Educational Resource Site Star

Related Articles:

<u>Current State of the</u> <u>Science: Health Effects and</u> <u>Indoor Environmental</u> <u>Quality</u>

Elements That Contribute to Healthy Building Design

<u>In Search of a Common</u> <u>European Approach to a</u> <u>Healthy Indoor</u> <u>Environment</u>

Childhood Asthma and Environmental Interventions

<u>Improving Indoor</u> <u>Environmental Quality for</u> <u>Public Health</u>

Bringing Green Homes within Reach: Healthier Housing for More People

Associations between ambient, personal, and



HVAC Systems and Indoor Environmental Quality

The following papers present research based information on the influence of HVAC systems on the indoor environments (determined by the building scientists) and subsequently the potential influence on the occupants health (determined by the health scientists). As always, it's important to not draw unsupported conclusions such as HVAC system and equipment directly improve peoples health; or develop creative interpretations such as HVAC systems prevent asthma. <u>The use of association to show causality can be very misleading.</u>

Is the indoor environment influenced by HVAC systems? Yes.

Does system type change how the indoor environment is influenced? Yes.

Can different systems improve aspects of indoor environmental quality? Yes.

Do some occupants benefit from improvements in indoor environmental quality? Yes.

<u>Building Science and Health Science</u>: An illustration separating and integrating the roles of the those in the building science field and those from the health science field.

indoor exposure to fine particulate matter.

<u>The Relationship of Housing</u> and Population Health:A <u>30-Year Retrospective</u> <u>Analysis</u>

Dr. Jessica Green, Microbes: Buildings are complex ecosystems

Dr. Charles J. Weschler, Healthy Buildings Research: New Developments, Future Directions and Potential Solutions

Quotes

Of new-onset asthma cases in adults, 15–23% are work-related asthma. American Thoracic Society 2004

The highest percentage of work-related asthma occurred among operators, fabricators, and laborers

Effects of the indoor environment on the fraction of exhaled nitric oxide in school-aged children

14. Suran, NJ Kulu, Migro of the independent of Rd	Effects due and some and traces our in fractions .
button of adultation will in orbit and dillition from Pray'r I	French sites and the barbary of a
184/active?	a second correspondence and the property of a
And Address of the Instantion of the Instantion of the	a particular and a second s
WW make in \$ - and assist to an an other sets in the bar	CONTRACT. In contractor in it factor distribution for
	APRIL control or a fits service in "relationing reprinted
MDB/TF/B: "Is include all differ to an investment registern into	In talks property of
stand area and a constant, many 2 to the	PROVIDE . Done light it shows expression due to a
hand and bing out the balance in generation on the hearth using generation	second provide the device the state of the second state of the sec
tion fig: got aspectation of collect and with a constraint	hard, is policy recommit a lation experiment has h of
nar a 100 kontra dal antica instali kontra latina hal'atribu inti-	sphere i's more upon its faults i'm generation of the
State and the second states from the second states	Figure restant regol actual: two is units that wide oncoming ingenerated in the advances for the Property sector actual for advances fo
Address to a party hardle of they, they are a photod represent.	have out a \$2 other other Philips
success. With and assesses of \$100, campited web designed and	Wadoo - o Degan
for only other fine depart backed being on control off a splitten more official a bally define \$100(07) and \$200.	HEADY, the stante set of an inter-
out strain (3-4,34). Hold on personal role economical	starts in WWW in it and a labor of \$1000, it has been to starts in the subset of a party of a section in the line in a
please states associate a repared office and. We parries if at	Name and Add available and representation optimized at a Rollin
And he are the second will a systemic loss fully a	involving the state and a real off to increase the paper of a little
table drifts (P-10) of a drifts oil speed steps	La ROT- of price and in an international devices and international feature in other statution of a statement of a statement of the statemen
being and the set of being state for an article.	time, but on, it day, our could', an ATE spillation
summing a second s	problem along the conference on the state of the light of the state of
shad one right a differ frame a Pffere set-stim be	unidean debegan antes an 1.00%
due altere quer a cour automotive	CONTRACTOR And A second distance of the local second secon
An Wester for Addance, Officer (1980), Safety States of the surface	make advanced ways of the descent of the second states of the second sta
and the second se	a bellegen ogen densem af ortsgager pass-sonen de offer til
	as fulfratures its conceptions,
A family provide preside month conducted on Final .	childred at grades in the Window Changin We Superfer
A Property approximation with specific approximate 27% of	share a summer of related on summericanty evaluationary R
have they in he filling [11]. Indian stickense verberte yna gebete	in shiftee. We prevently reported 170 shat Po7451 plicate
talls sears arrive telliningene is any shift (2) balance day	mini organ, ap-and height to believe the person of the s
team oringers on leases or siggs aris- and invighter.	ments unaple. The ACTO was higher in children of an
these manue to shake and abits with ordera, which	itsukts every sei nobil a la light a dollar
na rad to again and local units influenzation (2). Here	Misellanda arms dat a General Han a
and PEE's contacted to taightful, spitiated and relation- spinst will as the descention of the press of 10 contactor	while point or party permanent interest PU G and apply high addition, we have permanent interested into http://
and the second sec	spittures, or her personal discounsed has been
to the second seco	per that is bacify children, and prove to children's
unique opti and inframenti rolls, and is individ for	when and tasents alongst that didline talk address
of excession, strategies, 10. The Danhald concession of	the effected little
shahat 181 (Arren) games on his 1 and interests of sector	
allansation involuting vish femalical aspectic and atom	METTHODS
and applications, and the property with pro- affermation with the	We'ld an expected or to the Works (Makkan' Amore
keeps and as infalled contractional (2.1). The present and	Health Tank (2-7) which excluded select delition one
protogenticity affects of taken provenegated theory with	If you if you could a pairs it shared it instances
	Wydys: Steen Inday's ynt meddellawith o the offer
using officialities a support to child? It many street	
erne officeration a compart's schedul "It array stand Dependent of Schere, Chilters Hause Dependent Com-	rep of Design, "Research on Rainwards Divers, Hand
and passing a second to child? It and child	Read of Sector Street, 457 cloud (here of Sector Street)



Air change rate and concentration of formaldehyde in reisekrinal indeor air Statis I, tithen¹⁷, March Ling¹⁰, Band N, Davi Och C, Chan¹, Rank Ling¹⁰, ¹⁰ Statis C, Statis K, Sank Ling¹⁰, ¹⁰ Statis C, Sank S, Sank Ling¹⁰, ¹⁰ Statis C, Sank S, Sank Ling¹⁰, Sank S, Sank

i pagene el legi sub los e encomples fij estatudade binnes di Altago este al teles com la presenta de la completa de la contrata de la contrata de la completa el la contrata de la contra de la contrata de la contra de la contrata della de la contrata de la contrata della della contrata de la contrata della dell

ene externo circumstituite, our CTT - in how have a south v. Autom - how any how a south of the south of the

Association is a status, pa taking for a wear, of off-particip social, suit, as patient band, median denies therband. (MDF), and other metablan and participation and industry opport with an standard participation and others making MHD). (ME Barth) capacity, 2015. Associa- miding MHD). (ME Barth) capacity, 2015. Associa-	(a) and (b) (pp) elevants (pr) registry of signal control (second level) for the network level of a control of a second level of the second lev
	man's orient to contract schere et poster principa for brenchedori. I and Pik reporter bales sers al et (1) and Rigget ", response church Curate, Ohio.
(double) and has said a 1990 David (to 44 options	

New: Effects of the Indoor Environment on the Fraction of Exhaled Nitric Oxide in School-Aged Children

Study includes a look at hydronic radiant, forced air and electric baseboard heating systems.

citation: Kovesi, T.A., Dales, R.E., Effects of the indoor environment on the fraction of exhaled nitric oxide in school-aged children, Canadian Respiratory Journal, Vol.16 No 3 May/June 2009, © Pulsus Group Inc

<u>Air change rate and concentration of</u> <u>formaldehyde in residential indoor air</u>

The purpose of this study was to investigate the relationship between air change rates and indoor concentrations of formaldehyde; includes a look at heating systems.

citation: Gilbert, N. L., M. Guay, et al. (2008). "Air change rate and concentration of formaldehyde in residential indoor air." Atmospheric Environment, 42(10): 2424-2428.

(32.9%).

Worker Health Chartbook 2004

Between 35 and 60 million of the 89 million indoor environment workers have building-related symptoms of eye, nose, and throat irritations or headache and fatigue (Mendell 2002). Source: <u>National Institute</u> for Occupational Safety and <u>Health(NIOSH)</u>

Kids Health, "to maintain good air quality inside your home, ... "consider buying one with baseboard or radiant heating."

Source: <u>Kids Health Comes From</u> <u>Nemours</u>

Health based web sites and resources with HVAC recommendations

Sec.

Modeling the airborne survival of influenza virus in a residential setting: the impacts of home humidification

nne i Michell" Michel Martella Na degenerate La contesta presentaria industra fina manochara referenza da con sortes for tempo par en alexa contesta pello constituire. Contesta contesta manologa de contesta manologa pello mana en a pello contesta en alexa contesta contesta que pello constituire que contesta contesta de contesta de contesta pello contesta de contesta de contesta contesta que contesta contesta de contesta contesta de contest Contesta de contes

Which is the set of a spectro set of the se

Hadpender Hadpender Hadpender Haufender

) minetted Cottal

DMI		RESEARCH
BMJ	cheeling children: randomiser Piterinate Dama, other of intelli- nange (ale Bingin ferret) Pit-talet. Vet progi dynatic Vete, Nan disk ander (back) in the second second material of the second second second second bio second second second and back (back).	Ned Rean stability," Scid-Nichels, popurine in Agen, instanti-Niche, "Marate Camington, Ilado, R-S states," Vie Fallwein, postatemat e stabilite perfects and instances of environment
A strate intelligence of intelligence of the strategy of the s	Jahr Juan, period and posterior HERE CI Market CI Ma	C to Lar C anticine utility designs and a C (2014) C to Lar C anticine utility and anticine and a Lar C (2014) C and C (2014) C
Annual and a second sec	Introduced and products are accessed, while, include accesses are not observational advectors are spectra accesses, and power sectors and accesses affects and accesses are power sectors and accesses and accesses are accesses and accesses and accesses and requirements and accesses and an access and requirements and accesses and accesses and requirements and accesses and accesses and accesses accesses and accesses and accesses accesses and accesses and accesses accesses accesses accesses and accesses and accesses accesses accesses and accesses accesses accesses accesses accesses accesses accesses accesses accesses accesses accesses accesses accesses accesses accesses accesses accesses accesse	WHAT'S A start of the start of
10, 100 EV 10-1	which are advanced in the torus (). A diffusion control is a distribution of the torus () and () a	induces or impaired. The characteristic and the set methods, and a settingly strain to be supported dimensionless for the supportence in many former and being the bands constrained by the World Burdt Supportence. This is the same is free Subject of the Subject of the support of the same is the Subject of the Data Subject of the same is free Subject of the subject bands and processing the same is some with the

Modeling the airborne survival of influenza virus in a residential setting: the impacts of home humidification

Study explores the effects of humidification on influenza virus survival in rooms conditioned with radiant heating and forced air.

citation: Myatt, T.A, Kaufman, M.H., Allen, J.G., MacIntosh, D.L., Fabian, M.P., McDevitt, J.J., Modeling the airborne survival of influenza virus in a residential setting: the impacts of home humidification, Environmental Health 2010, 9:55

Effects of improved home heating on asthma in community dwelling children: randomised controlled trial

Study demonstrates benefits from certain heating systems.

citation: Howden-Chapman, P. et al, Effects of improved home heating on asthma in community dwelling children: randomised controlled trial, British Medical Journal (BMJ). 2008; 337: a1411. Published online 2008 September 23. doi: 10.1136/bmj.a1411. PMCID: PMC2658826

Asthma Foundation

Dr. Dean Mitchell's Allergy and Asthma Solution

> "..if you have control of deciding what heating to use for your home, ...consider radiant heating"



Construction of the second second

<u>Heat recovery ventilators prevent respiratory</u> <u>disorders in Inuit children</u>*

Study explores the use of HRV's to make improvements to the indoor air quality and demonstrates a benefit to the occupants.

citation: Kovesi, T., Zaloum, C., Stocco, C., Fugler, D., Dales, R. E., Ni, A., Barrowman, N., Gilbert, N. L., Miller, J.D., Heat recovery ventilators prevent respiratory disorders in Inuit children, Indoor Air 2009; 19: 489–499

*The above article is useful but we disagree with the title since any ventilation system would have the same results ergo its not exclusive to HRV's but the quality of the air.

A note on radiant heating and asthma.

As per my previous discussions cautioning the use of association to show causality; radiant systems in of themselves <u>do not</u> reduce asthma.

They also <u>do not</u> totally eliminate air movement as there will be both natural convection from the radiant surface and there will be forced convection from the necessarily required ventilation system (CSA F326 and ASHRAE 62.1 and 62.2).

The facts

What radiant systems do in

Air filters and air cleaners: Rostrum by the American Academy of Allergy, Asthma & Immunology Indoor Allergen Committee

eni, Boldel, MC, ¹⁴ Janes Milles, MC, Robert Boldead, MC, ¹7, Book Millers, PAC, ¹⁶ Janes Weber, MC, ek Polyakendal, NC, ML, ¹⁷ and its Arwiter Antiney of Hitney, Addines & Instandog Index Alonges Miller: Locatth, D, Fran, O.C. Asses TO, an Dicket, NL, and Patis, NLC

A derive for each of the sector of the secto

High Comparison of the Section of th

Comparing the second seco

Air filters and air cleaners: Rostrum by the American Academy of Allergy, Asthma & Immunology Indoor Allergen Committee

This paper provides an excellent overview on filtration from the perspective of healthcare professionals.

citation: Sublett JL, Seltzer J, Burkhead R, et al. Air Filters and Air Cleaners: Rostrum by the American Academy of Allergy, Asthma and Immunology Indoor Allergen Committee. J Allergy Clin Immunol.Volume 125, Issue 1, Pages 32-38, January 2010 comparison to all air systems is drastically reduce the volumetric airflow rate through the building thereby <u>potentially</u> reducing the recirculation and redistribution of airborne pollutants.

The secondary benefit with radiant coupled to dedicated outdoor air

systems, is the air system (collectively known as a hybrid) is designed and operated exclusively for treating the air for moisture, odours, gases and particulate - regardless of the need for space heating and cooling. Such dedicated ventilation systems often use energy recovery ventilators (HRV's or ERV's) and when ducted to each habitable space is considered by our team as the benchmark in ventilation design.

When incorporated into buildings constructed with materials having low toxicity, the above described system can greatly improve the health of the indoor environment which can be beneficial to all inhabitants but



Report of the Surgeon General's Workshop on Healthy Indoor Environment

This report is a comprehensive overview for the general public, the medical community, the public health community and those from the construction industry.

citation: Report of the Surgeon General's Workshop on Healthy Indoor Environment, National Institutes of Health, Bethesda, MD, Department of Health and Human Services, January 12–13, 2005

<u>Control of asthma triggers in indoor air with</u> <u>air cleaners: a modeling analysis</u>

Study examines peak and time-integrated concentrations of common asthma triggers present in indoor air over a year as a function of natural ventilation, portable air cleaners, and forced air ventilation equipped with conventional and high efficiency filtration systems.

citation: Myatt , T.A., Minegishi , T., Allen, J.G., MacIntosh, D.L., Control of asthma triggers in indoor air with air cleaners: a modeling analysis, Environmental Health 2008, 7:43doi:10.1186/1476-069X-7-43 particularly to those with respiratory illness and/or sensitivities to their surroundings.

If you are not clear about inappropriate use of association to show causality consider the following:

The earth is round basketballs are round, therefore the earth is a basketball. Clearly the conclusion is wrong even though the argument has validity.

Now consider this title, "<u>Heat recovery ventilators</u> <u>prevent respiratory</u> <u>disorders in Inuit children</u>".

It would be advantageous for manufacturers of heat recovery ventilators (HRV's) to use this to sell product since this actual paper is authored by recognized experts including a medical doctor. However, it was not the equipment itself which prevented respiratory disorders but the process of ventilation and filtration which can be accomplished Reactions of ozone with human skin lipids: Sources of carbonyls, dicarbonyls, and hydroxycarbonyls in indoor air

5	The state of the second st	entenning og hønselse forset av det forsetter en	
	other the second s	and a state of the second state and the second	
NAME OF TAXABLE PARTY			
	after termine	Reads and Managine	
	0		

This Provided PCF corresponds to the atches at a consisting on acceptation. Full hearthful PCF and the any PCR (investment will be made invalidate work. Association of investment discussion and an entry of the atchestices and disrembble : a marks analysis. Convenience Mark 2020; E. 2011; Distribution 2020; Williams J The (In/FriddBits) and Education of Investment J The (In/FriddBits) and

35% W15-00X
And-do type Route
Solar-adam
Solar-adam
Solar-adam
Solar-201
Acception-data
Si Nounctive 2010
And-do
Solar-201
And

Advan in Everymental Plastik va linde in Plakkel and antimat al Plakkel Central. For inferention along publicing you response in Everymental Youth or any Bolded Central and State and State Barrier and Advances and Advances and Advances for information advances the Enthel Central publicities and in Michael and advances and advances and advances and a <u>Reactions of ozone with human skin lipids:</u> <u>Sources of carbonyls, dicarbonyls, and</u> <u>hydroxycarbonyls in indoor air</u>

Study looks at skin reactions to ozone, implications for ventilation systems and naturally ventilated spaces.

citation: Wisthalera, A., Weschler, C.J., Reactions of ozone with human skin lipids: Sources of carbonyls, dicarbonyls, and hydroxycarbonyls in indoor air, Proceedings of the National Academy of Sciences, April 13, 2010 vol. 107 no. 15 6568-6575

Association of residential dampness and mold with respiratory tract infections and bronchitis

Study looks at dampness and mold associations with a variety of adverse respiratory health effects, including respiratory tract infections.

citation: Fisk, W.J., Eliseeva , E.A., Mendell, M.J., Association of residential dampness and mold with respiratory tract infections and bronchitis: a meta-analysis, Environmental Health 2010, 9:72 doi:10.1186/1476-069X-9-72

without the use of heat recovery ventilators.

This is a good example of the inappropriate use of association to show causality.

Remember this, "Scientific studies that show an association between a factor and a health effect do not necessarily imply that the factor causes the health effect".

For more on this topic <u>see</u> this presentation.

Elser Heating and Air Conditioning Systems	
Mohain Hashigado ² (Yanin Tachikar ² , Takinone Okuda ²), Okuda Tambid ² and Tamir-Oradi ²	
coloria Esternity conducts Reserve Estern coloria Coperation coloria Coperation	
Advances. The propose of \$60, ready one to incredigen the others of a fixer bundle goal of combining spinse, and containing particular control of the spin spin spin spin bundles goal on the spin spin spin spin spin spin spin bundles goals where on the transmission is a single spin spin spin bundles goals and \$71 and the bundles graves (\$1, \$56 are respondent of strage back larges to constitute at the spin spin of the maximum diffusion is to build at the spin spin spin spin of the maximum diffusion is to build at the spin spin spin spin spin spin spin spin	polyheid aras, sok a de lag in oder to easer desend control / Pipol adopted app Annu de App ArAA, adotting roung app ap generacija Kgenede flor hering system, si conditioning system dati produ physiologicatoropous, adjectice separat
(τ) The set of the transporter is to control 4.5 and 1.6 and 1.5 and 1.5 are the transporter is the transport of the trans	Detailed Detailed Detailed

Plexislogical and Subjective Requestes in the Ehlerb When Using

<u>Physiological and Subjective Responses in</u> <u>the Elderly When Using Floor Heating and Air</u> <u>Conditioning Systems</u>

Study looks at two groups of people exposed to radiant and air conditioning.

citation: Hashiguchi, N., Tochihara, Y., Ohnaka, T., Tsuchida, Chiaki, C., Otsuki, T., Physiological and Subjective Responses in the Elderly When Using Floor Heating and Air Conditioning Systems, Journal of physiological anthropology and applied human science, Vol. 23: 1345-3475, Nov. 2004

Housing characteristics, reported mold exposure, and asthma in the European Community Respiratory Health Survey

Study investigated associations between housing characteristics including heating systems, related to dampness, mold exposure, and house dust mite levels and adult asthma.

citation:Zock JP, Jarvis D, Luczynska C, Sunyer J, Burney P., European Community Respiratory Health Survey. Housing characteristics, reported mold exposure, and asthma in the European Community Respiratory Health Survey, J Allergy Clin Immunol. 2002;110:285-92. [PubMed: 12170270]

Periodological AUTEROPOLOGICAL

Additional reading

- Eccles, R., An explanation for the seasonality of acute upper respiratory tract viral infections. Acta Otolaryngol 2002; 122:183–191.
 http://tinyurl.com/mndbpph>
- Johnson, C., Eccles, R. Acute cooling of the feet and the onset of common cold symptoms. Family Practice 2005; 22: 608–613.
 http://fampra.oxfordjournals.org/content/22/6/608.full.pdf http://fampra.oxfordjournals.org/content/22/6/608.full.pdf
- Eccles. R., Acute cooling of the body surface and the common cold. Rhinology, 40, 000-000, 2002 <<u>http://tinyurl.com/kks92dc</u>>
- Yale University. "Cold virus replicates better at cooler temperatures." ScienceDaily. ScienceDaily, 5 January 2015. <www.sciencedaily.com/releases/2015/01/150105170014.htm>.

People who visited this page also visited these pages:

Study Links Maternal Exhaust Exposure to Childhood Asthma, Environmental

Epigenetics

The next frontier in IAQ research...visit nova program, "<u>Ghost in Your Genes</u>: Experts investigate how a mysterious 'second genome' helps determine our biological fates."

<u>The Health, Safety and Comfort Advantages of Low Temperature Heating</u> <u>Systems - A Literature Review</u>

Cortical, thalamic, and hypothalamic responses to cooling and warming the skin in awake humans

- Human Factors The body as an HVAC system
- Facts about the skin
- Using water heaters as space heaters the risk of Legionella and other bacteria
- Toxic homes, toxic bodies
- Tower of Babble
- Introduction to Indoor environmental Quality

<u>Home</u> | <u>Seminars</u> | <u>Solutions</u> | <u>Heating Cafe</u> | <u>Contribute</u> | <u>Online Help</u> | <u>Bean's Blog</u> | <u>About Us</u> | <u>Glossary</u> <u>Privacy Policy</u> | <u>Legal</u> | <u>Contact Us</u> | <u>Site Map</u> | <u>Carlson-Holohan Award</u> | <u>Send Us Your Comments</u>

Donate using PayPal, Credit Cards Accepted