
COMPARISON OF ELECTRIC HAND DRYERS AND PAPER TOWELS FOR HAND HYGIENE: A CRITICAL REVIEW OF THE LITERATURE

AN OVERVIEW OF THE SCOPING REVIEW CONDUCTED BY RESEARCHERS FROM THE UNIVERSITY OF ARIZONA, ZUCKERMAN COLLEGE OF PUBLIC HEALTH, AND PUBLISHED IN THE JOURNAL OF APPLIED MICROBIOLOGY, 14 AUGUST 2020

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WHAT IS A SCOPING REVIEW?

A scoping review is a type of research that seeks to examine and clarify broad areas to identify gaps in the evidence, clarify key concepts, and report on the types of evidence that address and inform practice in a topic area.

Scoping reviews are best designed for: "When a body of literature has not yet been comprehensively reviewed, or exhibits a large, complex, or heterogeneous nature not amenable to a more precise systematic review." (Peters M, Godfrey C, Khalil H, et al)

IF A NUMBER OF STUDIES EXIST ON A PARTICULAR TOPIC, AND THOSE RESULTS ARE VARIED OR CONFLICTING, A SCOPING REVIEW CAN HELP SIMPLIFY SOMETHING OTHERWISE COMPLEX. IN THE INSTANCE OF HAND DRYERS VS PAPER TOWELS, THE UNIVERSITY OF ARIZONA'S SCOPING REVIEW HELPED TO IDENTIFY WHICH HAND DRYING STUDIES ARE CREDIBLE AND SHOULD BE CONSULTED FOR THEIR RESULTS AND RECOMMENDATIONS.

ABSTRACT

The great debate of hand dryers vs. paper towels has gone on for years through studies largely funded by the paper towel industry and most recently by way of news articles and viral social media posts. The problem with these stories is that they are often one-sided and written in a manner to either sensationalize—elicit fear—or both. In short: they do not tell the whole story or share the whole truth.

To correct myths and educate the public, researchers at the University of Arizona, through an exhaustive two-year process, scoured available published studies, news articles and other gray literature that compared hand dryers and paper towels, identifying 293 pieces of literature and ultimately narrowing their focus to 23 that met their study criteria in a final analysis.

By categorizing and quantitatively prioritizing studies based on their scientific rigor in study design, and considering such factors as sample size, methodology, data quality and whether or not the study was set up to mimic a real-world scenario, they sought to answer the following questions:

- **ARE HAND DRYERS MORE HYGIENIC THAN PAPER TOWELS?**
- **ARE PAPER TOWELS SAFER THAN HAND DRYERS RELATIVE TO HUMAN INFECTION RISKS?**

They also examined each study's conclusions and the impact on public perception.

The results of their efforts include answers to the aforementioned; a classification of strengths and weaknesses of each study included in the review; and considerations for future studies.

OVERVIEW OF THE FINDINGS

Although numerous studies have been published evaluating the “best” method for hand drying, “best” has been defined in a variety of ways relative to bacterial removal efficacy, environmental contamination potentials, ecological or cost benefits, noise and more. To date, no study has examined the “best” drying method.

CONCLUSIONS

- THERE IS NO EMPIRICAL DATA TO SUPPORT ONE HAND DRYING METHOD OVER ANOTHER FROM A HEALTH AND SAFETY PERSPECTIVE.
- HAND DRYERS AND PAPER TOWELS HAVE BEEN FOUND TO BE EQUALLY HYGIENIC THROUGH A REVIEW OF AVAILABLE RESULTS OF SCIENTIFIC RESEARCH STUDIES.

PARAMETERS OF THE STUDY

1. RESEARCHERS IDENTIFIED THE RESEARCH QUESTIONS

- Are hand dryers more hygienic than paper towels?
- Are paper towels safer than hand dryers relative to human infection risks?

2. RELEVANT STUDIES WERE IDENTIFIED

Full-text articles and reports were selected if they met the following inclusion criteria: 1) involved quantitative assessments; 2) utilized sampling for environmental microbes or tracers; 3) evaluated one or more hand-drying method; 4) published in peer-reviewed literature. Case studies, reviews, systematic reviews and opinion articles were excluded from the quantitative synthesis but may have been included in the summary of gray literature, if they showcased analytical rigor and reported conclusions to identify gaps and future research needs.

3. STUDIES WERE SELECTED FOR INCLUSION

A search yielded 293 studies. Once this count was reviewed, duplicate references and studies found to be irrelevant to the topic were removed. Inclusion criteria, as outlined above, was then applied to the full text of 38 articles. Of these, 23 met the full set of criteria and were included in the final review.

4. DATA WAS CHARTED

Study categories included the following: sample size, variable consistency, methodology, realistic conditions, data quality, other and funding source. Each study category was scored quantitatively as positive/+, neutral, or negative/-, using a scoring system of 2, 1, and 0, respectively. Once the scores in each category were tallied, the study received a score for its rigor; the higher the score, the more credible the findings.

5. RESULTS WERE COLLATED, SUMMARIZED AND REPORTED

Once the studies were assigned scores relative to their rigor, the researchers were able to answer the research questions identified in the first parameter, provide an articulate conclusion of their findings, and recommend future studies on the topic of hand-drying methods and human health outcomes.

THE FINDINGS

ANSWERS TO RESEARCH QUESTIONS:

QUESTION 1: Are hand dryers more hygienic than paper towels?

FINDINGS: Hand dryers and paper towels were both found to be suitable hand drying solutions.

QUESTION 2: Are paper towels safer than hand dryers relative to human infection risks?

FINDINGS: There is no empirical data that supports one hand drying method over another from a health or safety perspective.

RIGOR

Scientific rigor means implementing the highest standards and best practices into the research being conducted. A relative rigor score was calculated by assigning Negative (-)= zero; Neutral= one; Positive (+)= two to the following categories:

- Funding
- Realistic Conditions
- Sample Size
- Methodology
- Variable Consistency
- Data Quality

THE STUDY THAT WAS FOUND TO HAVE THE HIGHEST RIGOR SCORE:

- THE MAYO CLINIC - EFFECTS OF 4 HAND-DRYING METHODS FOR REMOVING BACTERIA FROM WASHED HANDS: A RANDOMIZED TRIAL
- RIGOR SCORE OF II
- REPORTED: "...THERE IS NO DIFFERENCE IN BACTERIA COUNTS WHEN DRYING WITH PAPER TOWELS OR HAND DRYERS."

FUNDING

FIVE STUDIES FAVORING PAPER TOWELS WERE FUNDED BY THE EUROPEAN TISSUE SYMPOSIUM, A TRADE ASSOCIATION THAT REPRESENTS THE MAJORITY OF TISSUE PAPER PRODUCERS THROUGHOUT EUROPE. ADDITIONALLY, 4 OF THESE 5 STUDIES WERE CONDUCTED BY THE SAME RESEARCH COLLABORATORS.

Funding	Count
Private Funding Source	15
Public Funding Source	6
Funding Source Not Reported	1
None	1

The majority of the studies were sponsored by sources with potentially biased interests.

REALISTIC CONDITIONS

SOME STUDIES APPLIED PAINT TO PARTICIPANT'S HANDS DURING THE STUDY. WHILE THIS COULD HELP EVALUATE POTENTIAL CONTAMINATION OF RESTROOM SURFACES, IT DOES NOT HELP TO INVESTIGATE OR REPORT ON GERM TRANSFER, SURVIVAL, EXPOSURE POTENTIALS, OR HEALTH OUTCOMES.

Realistic Conditions	Count
Negative (-)= zero	10
Neutral= one	10
Positive (+)= two	3

The majority of the studies were not conducted in conditions one might encounter in the real world.

SAMPLE SIZE

LARGER SAMPLE SIZES GENERALLY PROVIDE MORE ACCURATE MEAN VALUES, IDENTIFY OUTLIERS THAT COULD SKEW THE DATA IN A SMALLER SAMPLE, AND PROVIDE A SMALLER MARGIN OF ERROR.

Sample Size	Count
Negative (-)= zero	7
Neutral= one	9
Positive (+)= two	7

The number of participants in the studies ranged from a few to greater than 100.

METHODOLOGY

METHODOLOGY THAT IS INCONSISTENT BETWEEN PARTICIPANTS OR THAT IS DIFFICULT TO REPLICATE IS UNLIKELY TO YIELD ACCURATE RESULTS. THE MAJORITY OF THE STUDIES INCLUDED AS PART OF THE REVIEW DID NOT HAVE A METHODOLOGY THAT WAS CONSIDERED A FAVORABLE STUDY ATTRIBUTE.

Methodology	Count
Negative (-)= zero	5
Neutral= one	10
Positive (+)= two	8

Research methodology includes the specific procedures or techniques used to identify, select, process, and analyze information about a topic.

A COMMON OBSERVATION IN THE RESEARCHER'S ANALYSIS IS THAT MOST OF THE STUDIES, REGARDLESS OF CONCLUSION, LACKED SUFFICIENT RIGOR TO FORM DEFENSIBLE CONCLUSIONS.

DATA QUALITY

THE QUALITY OF DATA WAS FOUND TO BE A STRENGTH OF 7 STUDIES.

Data Quality	Count
Negative (-)= zero	5
Neutral= one	11
Positive (+)= two	7

The quality of the findings, that is, their credibility and repeatability, were examined as part of the scoping review.

VARIABLE CONSISTENCY

ONLY 3 STUDIES WERE FOUND TO HAVE CONSTANT VARIABLES. THIS MEANS THAT IF REPLICATED, THESE 3 WOULD LIKELY YIELD THE SAME OUTCOMES OR RESULTS.

Variable Consistency	Count
Negative (-)= zero	13
Neutral= one	7
Positive (+)= two	3

The researchers examined each study to see if they were set up to be consistent. Variable consistency helps to ensure accurate results and consistent results if a study is replicated in the future.

NUMBERS BREAKDOWN

	Rigor Score	HD Favored	PT = HD	PT Favored
OF THE STUDIES WITH THE HIGHEST RIGOR, WE SEE: HD FAVORED IN 3 SCENARIOS; PT FAVORED IN 3 SCENARIOS; PT = HD IN 2 SCENARIOS	11	1	1	-
	10	1	-	-
	7	1	1	3
	6	1	1	2
	5	-	3	4
	4	1	1	2
	3	-	1	1
	2	1	-	1

HD FAVORED
THE TWO STUDIES WITH THE HIGHEST RIGOR SCORES FEATURED SCENARIOS FAVORABLE TO HAND DRYERS.

Rigor Score	Study Count
11	1
10	1
7	1
6	1
5	1
2	1

PT = HD
THE SCIENTIFIC RIGOR OF STUDIES FINDING PAPER TOWELS TO BE EQUAL TO HAND DRYERS

Rigor Score	Study Count
11	1
7	1
6	1
5	3
4	1
3	1

PT FAVORED
STUDY SCENARIOS FAVORING PAPER TOWELS GENERALLY LACKED SCIENTIFIC RIGOR.

Rigor Score	Study Count
7	3
6	2
5	4
4	3
3	1
2	1