

Luck of the Microbiologist – A Retrospective Observational Cohort Study

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Abstract

Aims

To examine the concept of “luck” in our Microbiology Department, by evaluating the number of significant blood culture and severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) results managed by healthcare workers (HCWs) in 2021.

Methods

A retrospective observational cohort study was conducted. The primary outcome was the number of significant blood cultures and SARS-CoV-2 results managed per HCW; and whether the difference between frequencies of the outcomes is statistically significant.

Results

15 medical scientists (HCWa-o) were involved in specimen processing, with 7 NCHDs (HWC1-7) and 5 Consultants (HCWA-E) tasked with clinical management. No statistically significant difference between the number of positive blood cultures handled by individuals was found. Regarding SARS-CoV-2 results, a statistically significant difference was observed among NCHDs ($H=35.51$, $p<0.01$) and Consultants ($H=9.51$, $p=0.05$). Data suggested that HCW3 was unluckier than fellow NCHDs and HCWD was luckier than fellow Consultants.

Discussion

All HCWs appeared to possess a similar quantity of luck. However, HCWD and HCW3, were luckier and unluckier respectively than colleagues, with luck possibly related to mindset as hypothesized by experts. Whether or not luck exists, in the era of considerable staff shortages and increased work-related stress, doctors should employ other methods to protect their wellbeing.

Introduction

Accurate and rapid diagnosis of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the ability to differentiate it from other pathogens causing similar symptoms was

essential for prompt clinical intervention and pandemic control; and the clinical microbiology laboratory has been required to adapt to the ever-changing landscape of tests and demands.¹

Prior to the pandemic, our University Hospital laboratory processed upwards of 900 patient specimens per day; and with the then anticipated increase in specimens for SARS-CoV-2 testing, all laboratories faced immediate challenges – staffing, technology, training and supply chains.²

An integral part of the Clinical Microbiology service is the timely communication of significant results and provision of advice on further diagnostics, therapeutics and infection prevention and control (IPC) management. Apart from SARS-CoV-2 and coordinating effective IPC strategies based on results, positive blood cultures make up the majority of critical specimens.

With the bombardment of large volumes of SARS-CoV-2 results on top of blood cultures, work in Clinical Microbiology became demanding. In the face of such immovable obstacles is it any wonder that staff hope that luck falls on their side?

Our study aims to determine whether some colleagues are indeed luckier than others, in terms of a reduced number of significant results – blood cultures and SARS-CoV-2 – when they are on service.

Methods

The Clinical Microbiology service includes, but is not limited to, medical scientists who process clinical specimens, non-consultant hospital doctors (NCHDs) who communicate preliminary results of critical samples and provide clinical advice during working hours (0900 – 1700 Monday – Friday) and consultant microbiologists who oversee departmental operations, train NCHDs and provide clinical service in- and out-of-hours. When a blood culture is positive, initial Gram-stain results are conveyed to admitting teams and clinical information is contextualised, so that pertinent advice regarding therapeutics and further diagnostics can be provided. Significant SARS-CoV-2 results i.e., when the polymerase chain reaction produces a “Detected” or “Equivocal” result, require interrogation of the clinical scenario and IPC management strategies including identification of close contacts, isolating or cohorting individuals and scheduling surveillance screening. Our study is a retrospective observational cohort study on the number of positive blood cultures and SARS-CoV-2 significant results managed by medical scientists, NCHDs and consultant microbiologists at our University Hospital in 2021.

The cumulative number of positive blood cultures and significant SARS-CoV-2 results attained by each NCHD and consultant microbiologist throughout 2021 was collected. The number of positive blood culture results processed by each medical scientist was also noted, but not SARS-CoV-2 results due to the high turnover and cross-cover of scientists processing same. The shifts worked by each HCW were also documented.

The primary outcome was the number of positive blood cultures and significant SARS-CoV-2 results managed per NCHD and consultant microbiologist, and medical scientist where applicable; and whether the difference between frequencies of the outcomes was statistically significant – as a measure of luck. A HCW was defined as being “lucky” if the observed proportion of their managed results was statistically significant and lower than their colleagues’ and vice versa.

Data was analysed using IBM SPSS version 26. Initial Welsh and Shapiro-Wilk tests were performed to assess homogeneity of variances and normality respectively. Parametric data was compared using a one-way analysis of variance (ANOVA), while non-parametric data was processed using a Kruskal Wallis analysis. Post-hoc testing was performed for statistically significant results, with values adjusted by the Bonferroni correction for multiple tests. A p value of <0.05 was deemed significant.

Results

3280 positive blood cultures were obtained in 2021. 15 medical scientists (HCWa-o) were involved in their processing, with 7 NCHDs (HWC1-7) and 5 consultants (HCWA-E) tasked with their clinical management. A means-plot is shown in Figure 1.

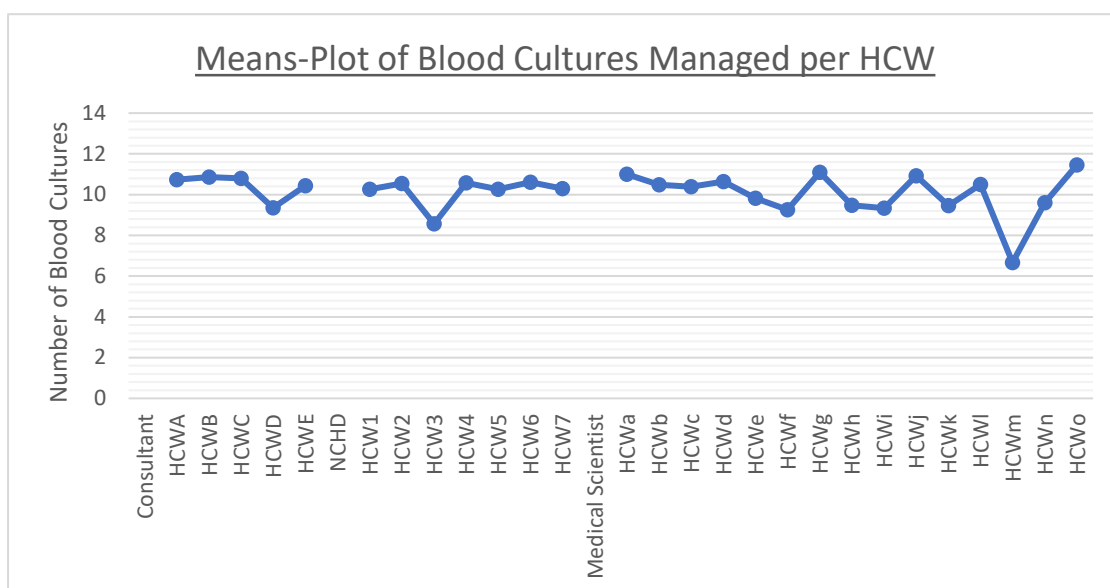


Figure 1: Means-Plot of Blood Cultures Managed per HCW

Welsh and Shapiro-Wilk tests found no statistically significant differences in homogeneity of variances and equality of means; and a subsequent one-way ANOVA similarly revealed no statistically significant difference between the number of positive blood cultures acquired by individuals (See Table 1). This therefore suggested that each HCW was as equally lucky when it came to positive blood culture results.

		Sum of Squares	df	Mean Square	F	p
Medical Scientists	Between Groups	267.23	14	19.09	0.87	0.58
	Within Groups	7613.60	350	21.75		
NCHDs	Between Groups	62.59	6	10.43	0.48	0.82
	Within Groups	7750.15	356	21.77		
Consultants	Between Groups	108.30	4	27.07	1.25	0.29
	Within Groups	7772.52	360	21.59		

Table 1: One-Way ANOVA Results for Blood Cultures Managed by HCWs

*df: Degrees of Freedom, F: ANOVA Statistic, p: Level of Significance

100617 SARS-CoV-2 specimens were processed in 2021, generating 3826 significant results, effectively communicated by abovementioned NCHDs and consultants. Distribution of results managed is shown in Figure 2.

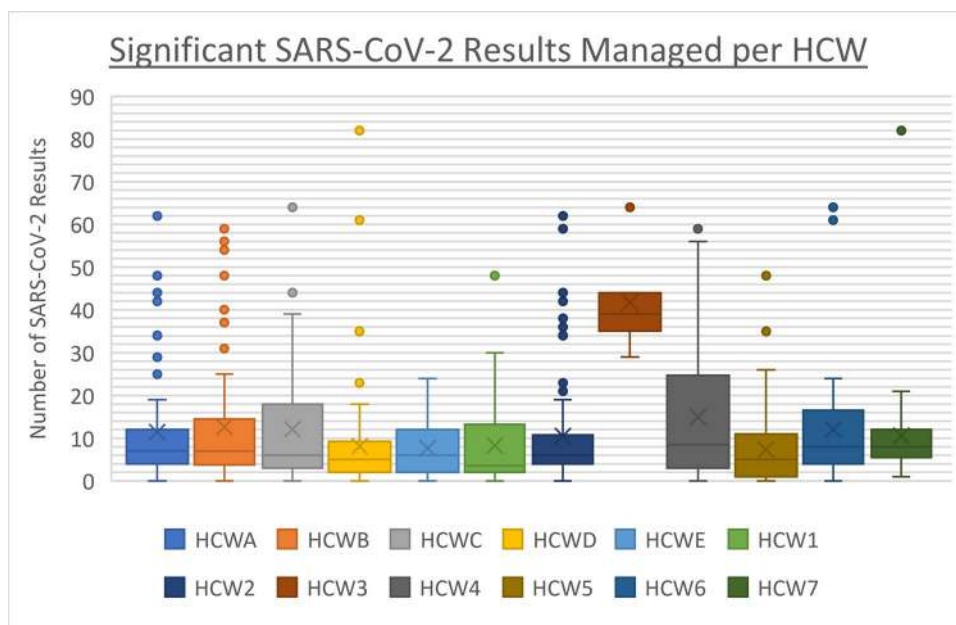


Figure 2: Box-Plot Showing the Distribution of Significant SARS-CoV-2 Results Managed per HCW

In this circumstance, Welsh and Shapiro-Wilk tests found statistically significant differences in homogeneity and equality of means between comparators and a Kruskal Wallis test was employed. A statistically significant difference was observed for NCHDs (H=35.51, p<0.01) and consultants (H=9.51, p=0.05). Post-hoc analysis adjusted by the Bonferroni correction revealed statistically significant differences between HCW3 and all other NCHDs, and HCWD and all other Consultants (See Table 2, only statistically significant pairwise comparisons are shown). Coupled with the greatest (346.71) and lowest (152.71) mean ranks respectively, data suggested that HCW3 was unluckier than fellow NCHDs and HCWD was luckier than fellow consultants when it came to SARS-CoV-2 results.

	Kruskal-Wallis H	df	p
NCHDs	35.51	6	<0.01
<i>HCW3 – HCW1</i>			<0.01
<i>HCW3 – HCW2</i>			0.01
<i>HCW3 – HCW4</i>			0.02
<i>HCW3 – HCW5</i>			<0.01
<i>HCW3 – HCW6</i>			0.02
<i>HCW3 – HCW7</i>			0.04
Consultants	9.51	4	0.05
<i>HCWD – HCWA</i>			0.01
<i>HCWD – HCWB</i>			0.02
<i>HCWD – HCWC</i>			0.02

Table 2: Kruskal Wallis Results for SARS-CoV-2 Results Managed by HCWs
**H: Kruskal-Wallis statistic, df: Degrees of Freedom, p: Level of Significance*

A subgroup analysis was performed looking at results obtained solely during weekends and public holidays. All results were statistically insignificant across all variables.

Discussion

As the pandemic progressed, the demand for SARS-CoV-2 testing skyrocketed and microbiology laboratories had to adapt and respond rapidly.^{3,4}

Changes in laboratory processes such as the implementation of molecular-based testing platforms necessitated training, new documentation and communication interfaces. Major

changes in working arrangements generated significant workload for laboratory personnel and changes in work structure impacted staff morale, especially early in the pandemic when anxiety levels were high.⁴

Clinical microbiologists interpret and advise on a multitude of results daily. For 2021 alone, 3280 positive blood cultures were examined by the Clinical Microbiology team, in addition to the numerous theatre specimens, wound swabs, bodily fluids and environmental sampling that warrant the same dedication. These coupled with the 3826 SARS-CoV-2 results which necessitated thorough assessment and IPC input, not only at an individual basis but institutional and national level, is enough to make anyone hope for an uneventful shift and that luck is on their side.

“The luck of the Irish” is a common saying attributable to the fortunes and successes of Irish miners in the 19th Century. The word “luck” itself is Middle Dutch in origin and comes from “luc” meaning happiness or good fortune.⁵

As many believe, certain HCWs experience the worst of fortune. But, does bad luck actually attach itself like curses to persons?⁶ Do some individuals carry around a foreboding dark cloud like Eeyore?⁷ Various studies have dispelled this notion by suggesting that reputations are earned; not from ill fate, but from complaints about what was *perceived* as proportionally greater work, accompanied by decreased efficiency.^{6, 8}

Interestingly, our data shows that apparent luck differed in terms of the nature of significant result. Blood cultures were equivalent suggesting that all HCWs were as equally lucky in this category of specimen. However, for SARS-CoV-2, a greater disparity is seen. As medical scientists were not included in this analysis, information on their perceived luckiness is unknown. Though, statistical significance was noted among NCHDs and consultants, particularly between HCW3 and fellow NCHDs and HCWD and fellow consultants.

Richard Wiseman, author of “The Luck Factor” and professor of psychology at the University of Hertfordshire, does not believe there is anything magical or superstitious about luck; but rather considering oneself lucky or unlucky is a way of seeing oneself which then has an impact on how one behaves and how one thinks, and in turn becomes a self-fulfilling divination. So, in a sense, it does exist and can be influenced; not with charms or trinkets but rather mindset.^{9, 10}

HCWD possessed the lowest mean rank within a statistically significant cohort, suggesting that HCWD is luckier than equals; with the opposite true for HCW3. Remarkably, this was prophesized by both HCWs at the onset of this study. Is this the mindset that Mr Wiseman

alludes to? Can having a positive or negative mindset actually impact on workload? Furthermore, in the face of a global pandemic, can luck or mindset really impact on incidence? From our albeit small study, it may appear so, at least for certain individuals.

Previous work has focused on various treatment outcomes and Emergency Department attendances and their relationship to the lunar cycle^{11, 12, 13} and semantic word usage – with a focus on the utterance of the word “quiet”^{14, 15} – all of which confirms that superstitions will not ease the heavy workload faced by HCWs.

Collectively, clinical microbiology laboratories will continue to face tremendous pressures. In our institution, the resilience of our team has kept us afloat this far and we continue to rely on our dedication and ingenuity to see us through, not luck. HCWs need to be resilient and mindful to care for their own wellbeing as well as those around them.^{2, 15}

Being of a small sample size over a defined period of time among a specific cohort of personnel limits the generalizability of information of our study. However, it can be argued that luck itself is individualised and that a study of this nature is not meant to be generalised. We focussed only on significant blood culture and SARS-CoV-2 results, which make up a small fraction of the results managed by Clinical Microbiology. If all facets were included, outcomes may have been different. Furthermore, as the pandemic evolved, so too did the waves of SARS-CoV-2 incidence and not all HCWs would have been on service during a peak or trough so that exposure was not uniform. Regarding subsets of data, we looked at all days and then only weekends and holidays, but the possibility exists that luck may have changed on full moons, Friday 13th's, during astrological phenomena or in the presence of black cats and broken mirrors. Luck is an entity that may or may not exist and work is based on inferences and correlations, which in itself is a limitation.

For the most part, all HCWs appear to possess a similar quantity of luck. However, attention must be paid to HCWD and HCW3, who was luckier and unluckier respectively than colleagues, with luck possibly related to mindset as hypothesized by experts. Cultural anthropology suggests that irrationalities – superstition and luck – cluster around uncontrollable elements that jeopardize well-being, such as a heavy workload. These beliefs provide us with a sense of understanding and control that otherwise may not exist. But do they exist and can they be influenced? Doctors should continue to look to other methods to increase resilience and protect their wellbeing, and not depend on superstition solely.

Declarations of Conflicts of Interest:

None declared.

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