1   Wearing a red uniform shortens lifespan in Starfleet officers

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3   [1] Starfleet

4   Author Note

11   Abstract

12   Damn it, man, I'm a doctor, not an undertaker!

13   *Keywords:* Starfleet Uniform, Space Exploration, Lifespan

14   Word count: 1260

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16   **Introduction**

17   "Enterprise Medical Log, Stardate 5327.4. Dr. Leonard McCoy recording.

18   Captain Kirk and First Officer Spock were rescued 48 hours ago, along with

19   several deceased members of the away team. They do not know why the

20   creature ignored them during the attack, but I have my suspicions. The victims

21   were all wearing red shirts."—McCoy (5327)

22   I am haunted by an uncomfortable reality: Over the past several weeks the number of

23 deaths I have listed on the *Enterprise*[1] is growing, and no matter the circumstance they all

24 share one thing in common—each and every one of them wore a red uniform. I approached

25 First Officer Spock with my concerns, but he brushed me off as thinking with undue

26 emotions. Our operations division wears red uniforms, so this pattern of deaths was

27 "logical" (Spock, 2287).

28   Despite that damn Vulcan's logic, he could not explain why himself and Captain Kirk

29 had not yet suffered similar fates. I can find no reason why they are still alive, except,

30 possibly, that the colour of their uniforms is somehow involved. Although improbable, it is

31 the only hypothesis I have. Captain Kirk has employed Spock and I to conduct a study to

32 investigate.

33   The aim of our study is simple: We will test whether the uniform colour of Starfleet

34 officers on board the Enterprise cause them to suffer more severe injuries during away

35 missions. I hypothesize that, regardless of their division, officers wearing red uniforms will

36 suffer more severe injuries. Spock states that this is illogical, and hypothesizes that

37 members of the operations division will continue to suffer more severe injuries no matter

38 their uniform colour.

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[1] The USS Enterprise (NCC-1701), a Constitution-class starship launched by Starfleet in the year 2245.

₃₉   **Methodology**

₄₀ **Participants**

₄₁   423 Starfleet officers on board the starship Enterprise participated in our study, 305

₄₂ of which identified as men ($M_{age} = 35.53$, $SD_{age} = 11.27$) and 118 as women ($M_{age} = 36.21$,

₄₃ $SD_{age} = 11.51$). Myself, First Officer Spock, and Captain Kirk did not participate in the

₄₄ study. Six redshirts who were supposed to participate were excluded from the study. A can

₄₅ be seen in Figure 1, Captain Kirk foolishly sent them on an away mission; we have lost all

₄₆ contact since.

Figure 1. Captain Kirk sending a team of redshirts on an away mission to the Klingon supermarkets on Qo'noS.

₄₇ **Design**

₄₈   We used a 3x3 independent design to test our hypotheses, with division

₄₉ (science/medical, command, operations) and uniform colour (blue, yellow, red) as

₅₀ independent variables. The Starfleet designations for divisions and their uniform colours

₅₁ can be seen in Figure 2. Severity of injury—our dependent variable—was measured on a

₅₂ 10-point scale developed by Phlox (2153), where one represented the lowest severity and

₅₃ ten the highest. Examples of lower severity injuries include broken bones, cellular damage,

54 or curable infections obtained during copulation with an alien species. Higher severity

55 injuries include decapitation by Bat'leth, exposure to delta-particle radiation, or being

56 crushed by Tribbles.[2]

Figure 2. Depiction of Starfleet divisions and their respective uniform colours.

57 **Procedure**

58   Our procedure was simple, although imperfect as First Officer Spock wants us to

59 remind you. Each Starfleet officer was randomly assigned a uniform colour they were to

60 wear over a one month period, however, they remained within their current division due to

61 operational constraints. Aside from this, each officer continued with their regular duties

62 aboard the Enterprise. My medical team and I then recorded the severity of injury,

63 division, and uniform colour for any patients that came into sickbay during the study

64 period. Patients with multiple visits had their severity of injury scores averaged at the end

65 of the period so their was only one score per participant.

66   **Results**

67 **Two-way ANOVA assumptions**

68   Our data met two of the assumptions for an independent two-way ANOVA.

69 Specifically, injury severity was measured on an interval scale, all observations for injury

70 severity were independent, and Levene's test showed that the variances for injury severity

71 between each of the experiment cells were equal, $F(8, 414) = 0.99$, $p = .447$. One

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[2] A Klingon's worst nightmare.

72 assumption was not met. Shapiro-Wilk's test of normality showed that the distribution of

73 injury severity within most of the experiment cells was significantly different from a normal

74 distribution (see Table 1); however, as discussed in Mudd (2266), meeting this assumption

75 is unnecessary for our analyses due to statistical advances in the late 21st century. Because

76 of this, we continued with our analysis as planned.

Table 1

Table Showing Assumption of Normality Tests.

Cell	*Skewness*	*Kurtosis*	*W*	*df*	*p*
Command Blue	0.09	2.62	0.95	47	.062
Command Red	-0.09	2.37	0.93	47	.010
Command Yellow	-0.04	2.63	0.95	47	.052
Operations Blue	0.21	2.75	0.93	47	.008
Operations Red	-0.49	2.73	0.92	47	.002
Operations Yellow	-0.39	2.30	0.93	47	.010
Science Medical Blue	-0.22	2.67	0.95	47	.029
Science Medical Red	-0.13	2.78	0.94	47	.027
Science Medical Yellow	0.21	2.55	0.94	47	.021

Two-way ANOVA results

78 There was no significant main effect of division, $F(2, 414) = 1.23$, $p = .292$, $\omega_p^2 = .001$,

79 nor was there a significant interaction effect, $F(4, 414) = 1.64$, $p = .163$, $\omega_p^2 = .006$. In

80 support of my hypothesis (and in contempt of Spock's), there was a significant main effect

81 of uniform colour on severity of injury, $F(2, 414) = 352.20$, $p < .001$, $\omega_p^2 = .624$. This

82 indicates different uniform colours affected the severity of injuries Starfleet officers suffered.

83 Specifically, post-hoc pairwise comparisons corrected using the Tukey method found that

84 officers wearing red uniforms ($M = 7.85$, $SD = 1.37$) suffered significantly worse injuries

85 than officers wearing blue uniforms ($M = 4.00$, $SD = 1.32$), $t(414) = 23.26$, $p_{adj} < .001$,

86 $d = 2.770$, or yellow uniforms ($M = 4.09$, $SD = 1.49$), $t(414) = 22.70$, $p_{adj} < .001$,

87 $d = 2.704$. However, officers wearing blue and yellow uniforms had no difference in the

88 severity of their injuries, $t(414) = 0.56$, $p_{adj} = .843$, $d = .066$. Thus, my hypothesis was

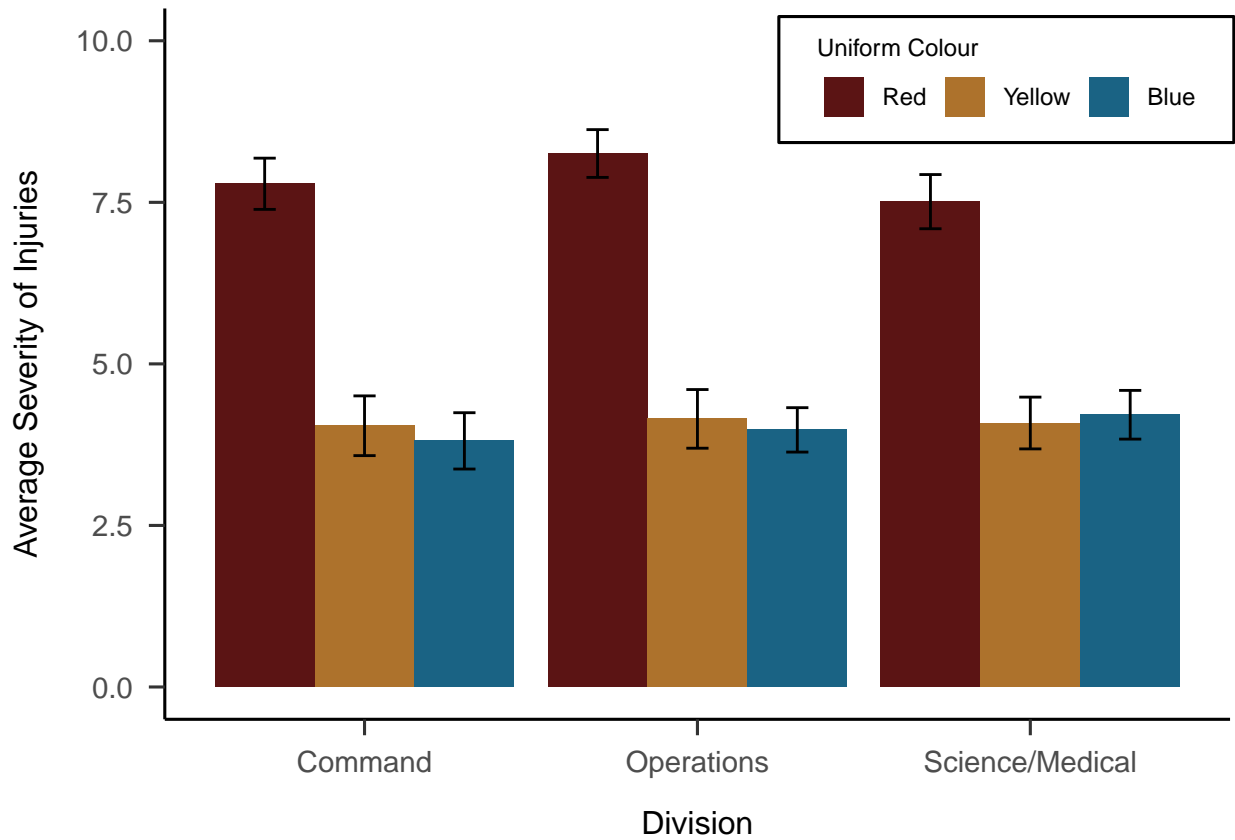89 confirmed. These differences can be seen in Figure 3.

Figure 3. Two science officers dawning a red Starfleet uniform (A). The result of said uniform on their lifespans (B).

Discussion

90

91　　The results of our experiment confirmed that wearing a red uniform causes Starfleet

92 officers to suffer more severe injuries, regardless of the division they work in. However, our

⁹³ results do not confirm the source of causality. That is, are the uniforms causing Starfleet

⁹⁴ officers to behave more recklessly, resulting in more severe injuries; or are the uniforms

⁹⁵ inviting external dangers across the cosmos? As of now we are unsure, but preliminary

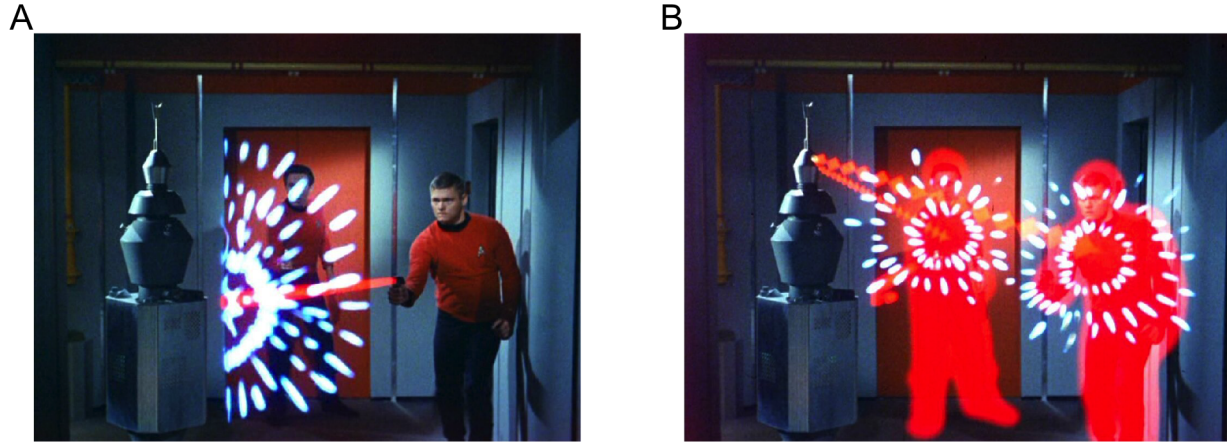⁹⁶ data suggests the former may be the culprit (see Figure 4).

Figure 4. Two science officers dawning a red Starfleet uniform (A). The result of said uniform on their lifespans (B).

Limitations

⁹⁸ Spock would like to remind our readers that, because their was no random

⁹⁹ assignment to division, this is not a true experiment. So our results should be taken with

¹⁰⁰ caution. Future studies building on the work here should consider randomly assigning

¹⁰¹ participants both a uniform colour *and* division. Training exercises at Starfleet Academy

¹⁰² would be an excellent candidate for such an experiment.

<div align="center">

Conclusion

</div>

¹⁰⁴ It appears, after careful observation, that wearing a red Starfleet uniform during

¹⁰⁵ space exploration is bad for one's health, often leading to an untimely demise. As a doctor

¹⁰⁶ who does not wish to become an undertaker, it is my recommendation that Starfleet

107 investigate the cause(s) underlying red uniform's effects on officer behaviour. To boldly go

108 where no one has gone before.

Open Science

110   The code and materials for analyzing data and generating the manuscript for this

111 project are available in the project's GitHub repository. This project was written using R

112 version 4.0.3 (2020-10-10) (R Core Team, 2020) in RStudio version 1.4.1103 (RStudio

113 Team, 2021). Statistical analyses were done using the `moments` (Komsta & Novomestky,

114 2015), `car` (Fox & Weisberg, 2019), `stats` (R Core Team, 2020), and `emmeans` (Lenth,

115 2021) R packages. To easily inspect the intermediate output of data analysis code pipes

116 from this manuscript, we suggest using the `boomer` (Fabri, 2021) R package. All packages

117 and dependencies used in this project can be seen in Table 2:

Table 2

All Packages and Dependencies for this Project.

Package	Version	Source
BH	1.75.0-0	CRAN
DBI	1.1.1	CRAN
Formula	1.2-4	CRAN
Hmisc	4.4-2	CRAN
MASS	7.3-53	CRAN
Matrix	1.3-2	CRAN
MatrixModels	0.4-1	CRAN
R6	2.5.0	CRAN
RColorBrewer	1.1-2	CRAN
Rcpp	1.0.6	CRAN
RcppArmadillo	0.10.1.2.2	CRAN

Table 2

All Packages and Dependencies for this Project. (continued)

Package	Version	Source
RcppEigen	0.3.3.9.1	CRAN
SparseM	1.78	CRAN
abind	1.4-5	CRAN
askpass	1.1	CRAN
assertthat	0.2.1	CRAN
backports	1.2.1	CRAN
base64enc	0.1-3	CRAN
bayestestR	0.8.2	CRAN
blob	1.2.1	CRAN
bookdown	0.21	CRAN
boomer	0.0.0.9000	NULL
boot	1.3-26	CRAN
brio	1.1.1	CRAN
broom	0.7.4	CRAN
callr	3.5.1	CRAN
car	3.0-10	CRAN
carData	3.0-4	CRAN
cellranger	1.1.0	CRAN
checkmate	2.0.0	CRAN
cli	2.3.0	CRAN
clipr	0.7.1	CRAN
cluster	2.1.0	CRAN

Table 2

All Packages and Dependencies for this Project. (continued)

Package	Version	Source
colorspace	2.0-0	CRAN
conquer	1.0.2	CRAN
cpp11	0.2.6	CRAN
crayon	1.4.1	CRAN
curl	4.3	CRAN
data.table	1.13.6	CRAN
dbplyr	2.1.0	CRAN
desc	1.2.0	CRAN
diffobj	0.3.3	CRAN
digest	0.6.27	CRAN
distill	1.2	CRAN
downlit	0.2.1	CRAN
dplyr	1.0.4	CRAN
effectsize	0.4.3	CRAN
ellipsis	0.3.1	CRAN
emmeans	1.5.4	CRAN
english	1.2-5	CRAN
estimability	1.3	CRAN
evaluate	0.14	CRAN
fansi	0.4.2	CRAN
farver	2.0.3	CRAN
forcats	0.5.1	CRAN

Table 2

All Packages and Dependencies for this Project. (continued)

Package	Version	Source
foreign	0.8-81	CRAN
fs	1.5.0	CRAN
generics	0.1.0	CRAN
ggplot2	3.3.3	CRAN
glue	1.4.2	CRAN
gridExtra	2.3	CRAN
gtable	0.3.0	CRAN
haven	2.3.1	CRAN
here	1.0.1	CRAN
highr	0.8	CRAN
hms	1.0.0	CRAN
htmlTable	2.1.0	CRAN
htmltools	0.5.1.1	CRAN
htmlwidgets	1.5.3	CRAN
httr	1.4.2	CRAN
insight	0.12.0	CRAN
isoband	0.2.3	CRAN
jpeg	0.1-8.1	CRAN
jsonlite	1.7.2	CRAN
kableExtra	1.3.1	CRAN
knitr	1.31	CRAN
labeling	0.4.2	CRAN

Table 2

All Packages and Dependencies for this Project. (continued)

Package	Version	Source
lattice	0.20-41	CRAN
latticeExtra	0.6-29	CRAN
lifecycle	0.2.0	CRAN
lme4	1.1-26	CRAN
lubridate	1.7.9.2	CRAN
magick	2.6.0	CRAN
magrittr	2.0.1	CRAN
maptools	1.0-2	CRAN
markdown	1.1	CRAN
matrixStats	0.58.0	CRAN
mgcv	1.8-33	CRAN
mime	0.9	CRAN
minqa	1.2.4	CRAN
modelr	0.1.8	CRAN
moments	0.14	CRAN
munsell	0.5.0	CRAN
mvtnorm	1.1-1	CRAN
nlme	3.1-151	CRAN
nloptr	1.2.2.2	CRAN
nnet	7.3-15	CRAN
numDeriv	2016.8-1.1	CRAN
openssl	1.4.3	CRAN

Table 2

All Packages and Dependencies for this Project. (continued)

Package	Version	Source
openxlsx	4.2.3	CRAN
papaja	0.1.0.9997	NULL
parameters	0.11.0	CRAN
patchwork	1.1.1	CRAN
pbkrtest	0.5-0.1	CRAN
pillar	1.4.7	CRAN
pkgbuild	1.2.0	CRAN
pkgconfig	2.0.3	CRAN
pkgload	1.1.0	CRAN
plyr	1.8.6	CRAN
png	0.1-7	CRAN
praise	1.0.0	CRAN
prettyunits	1.1.1	CRAN
processx	3.4.5	CRAN
progress	1.2.2	CRAN
ps	1.5.0	CRAN
purrr	0.3.4	CRAN
quantreg	5.83	CRAN
readr	1.4.0	CRAN
readxl	1.3.1	CRAN
rematch	1.0.1	CRAN
rematch2	2.1.2	CRAN

Table 2

All Packages and Dependencies for this Project. (continued)

Package	Version	Source
renv	0.12.5	CRAN
reprex	1.0.0	CRAN
rio	0.5.16	CRAN
rlang	0.4.10	CRAN
rmarkdown	2.6	CRAN
rmdfiltr	0.1.3	CRAN
rpart	4.1-15	CRAN
rprojroot	2.0.2	CRAN
rstudioapi	0.13	CRAN
rvest	0.3.6	CRAN
scales	1.1.1	CRAN
selectr	0.4-2	CRAN
sp	1.4-5	CRAN
statmod	1.4.35	CRAN
stringi	1.5.3	CRAN
stringr	1.4.0	CRAN
survival	3.2-7	CRAN
sys	3.4	CRAN
testthat	3.0.1	CRAN
tibble	3.0.6	CRAN
tidyr	1.1.2	CRAN
tidyselect	1.1.0	CRAN

Table 2

All Packages and Dependencies for this Project. (continued)

Package	Version	Source
tidyverse	1.3.0	CRAN
tinytex	0.29	CRAN
trekcolors	0.1.2	CRAN
utf8	1.1.4	CRAN
vctrs	0.3.6	CRAN
viridis	0.5.1	CRAN
viridisLite	0.3.0	CRAN
waldo	0.2.3	CRAN
webshot	0.5.2	CRAN
whisker	0.4	CRAN
withr	2.4.1	CRAN
xfun	0.20	CRAN
xml2	1.3.2	CRAN
xtable	1.8-4	CRAN
yaml	2.2.1	CRAN
zip	2.1.1	CRAN

Author Contributions

McCoy came up with the idea for this experiment and conducted all data collection and analysis. McCoy and Spock wrote this paper, however, Spock's main contribution was merely questioning McCoy's logic.

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