

Gender, social norms, and survival in maritime disasters

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Since the sinking of the *Titanic*, there has been a widespread belief that the social norm of “women and children first” (WCF) gives women a survival advantage over men in maritime disasters, and that captains and crew members give priority to passengers. We analyze a database of 18 maritime disasters spanning three centuries, covering the fate of over 15,000 individuals of more than 30 nationalities. Our results provide a unique picture of maritime disasters. Women have a distinct survival disadvantage compared with men. Captains and crew survive at a significantly higher rate than passengers. We also find that: the captain has the power to enforce normative behavior; there seems to be no association between duration of a disaster and the impact of social norms; women fare no better when they constitute a small share of the ship’s complement; the length of the voyage before the disaster appears to have no impact on women’s relative survival rate; the sex gap in survival rates has declined since World War I; and women have a larger disadvantage in British shipwrecks. Taken together, our findings show that human behavior in life-and-death situations is best captured by the expression “every man for himself.”

altruism | discrimination | homo economicus | leadership | mortality

On April 15, 2012, a century had passed since RMS *Titanic* sank in the North Atlantic Ocean. The *Titanic* disaster has generated immense public and scholarly interest and, as one of the most extensively covered events in history, obtained an almost mythological status. The evacuation of the *Titanic* serves as the prime example of chivalry at sea. Men stood back, while women and children were given priority to board the lifeboats. In the end, 70% of the women and children were saved compared with only 20% of the men (1). The social norm of saving “women and children first” (WCF) in shipwrecks has often been referred to as the “unwritten law of the sea.”

It is well known that social norms of fairness and cooperation influence human behavior in a wide range of situations (2, 3). For instance, charitable giving and donation of blood and organs is widespread (4–6). Men and women are, however, subject to different norms of helping behavior (7, 8). Men are in general expected to help people in emergencies, whereas women are, to a higher degree, expected to engage in care over the long term. The expectation of men to display chivalry and heroism in maritime disasters can be seen as an archetypal example of sex differences in social norms of helping behavior. Men displaying extreme altruism in disasters contrasts the picture from economic experiments in which men tend to be more selfish than women (9).

Rational individuals, whether with self-regarding or other-regarding preferences, compare the benefits and costs of helping. When helping substantially increases the risk of dying, it would be rational for most individuals to save themselves rather than helping others. This cost–benefit logic is fundamental in economic models of human behavior, including models in which individuals choose to comply with or violate social norms, for instance by committing crimes (10).

Maritime disasters provide a valuable context in which it is possible to empirically investigate how people act and organize behavior in life-and-death situations and, in particular, if social norms of helping behavior are being upheld. However, so far,

only the shipwrecks of the *Titanic* and the *Lusitania* have been analyzed with respect to sex and survival (1, 11–14). It has been concluded that the men on board the *Titanic* followed the norm of WCF (11, 12). Based on a comparison of the *Titanic* and the *Lusitania* (where the former sank in 160 min and the latter in less than 20 min), a conjecture has been suggested to the effect that norm compliance is more pronounced in disasters that evolve slowly (11, 12).

Do women normally have a survival advantage in maritime disasters or was the evacuation of the *Titanic* an exception? What situational and cultural conditions determine who survives and who dies? And what role does the captain play?

To address these questions, we have compiled and analyzed a database of 18 maritime disasters over the period 1852–2011 (Table 1). Our data cover the fate of over 15,000 passengers and crew members of more than 30 different nationalities.

Eight hypotheses are tested. The first and main hypothesis (H1) is that women have a survival advantage over men in maritime disasters. Previous research on the *Titanic* has found, in line with the notion of WCF, that women have a survival advantage over men, whereas evidence from the *Lusitania* disaster indicates no difference in survival rates between men and women (11, 12). There are, however, several reasons to believe that men have better survival prospects than women, if they do not engage in self-sacrificing helping behavior. The most important argument would be that men are physically stronger than women. In the evacuation of a sinking ship, success is typically determined by the ability to move fast through corridors and stairs, which is often made difficult by heavy list, congestion, and debris. Other traits that may enhance survival prospects, such as aggressiveness, competitiveness, and swimming ability, are also more prevalent in men (9, 15–17), whereas for example resistance to cold water may benefit either sex (18–20). Accordingly, if men try to save themselves, we expect women to have a relative survival disadvantage. We would, however, expect women’s survival chances to improve if men comply with the norm of WCF. Hence, an observed survival advantage of women is regarded as supporting evidence of behavior being governed by the WCF norm. A small survival disadvantage for women is difficult to interpret, as it can either indicate that the WCF norm has helped women from a potentially larger disadvantage or that the norm has not been upheld. However, if we observe a substantial survival disadvantage of women we regard it as evidence that compliance with the WCF norm is exceptional in maritime disasters.

As a second hypothesis (H2), we posit that crew members have a survival advantage over passengers. According to maritime conventions, it is the duty of crew members—and in particular the captain—to conduct a safe evacuation of the ship (21). If the crew

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Table 1. Maritime disasters from 1852 to 2011

Name of ship	Nationality	Year	Cause of disaster	Water	Duration	WCF order	Voyage, days	Women, % of passengers	Casualties	Survivors
HMS <i>Birkenhead</i>	British	1852	Grounding	Indian Ocean, South Africa	Quick	Yes	21	1.4	365	191
SS <i>Arctic</i>	US	1854	Collision	North Atlantic, Canada	Slow	Yes	6	39.7	227	41
SS <i>Golden Gate</i>	US	1862	Fire	Pacific Ocean, Mexico	Slow	No	6	16.3	206	172
SS <i>Northfleet</i>	British	1873	Collision	English Channel, United Kingdom	Slow	Yes	9	22.8	287	80
RMS <i>Atlantic</i>	British	1873	Grounding	North Atlantic, Canada	Slow	No	12	29.6	538	330
SS <i>Princess Alice</i>	British	1878	Collision	River Thames, United Kingdom	Quick	No	1	56.8	697	140
SS <i>Norge</i>	Danish	1904	Grounding	North Atlantic, United Kingdom	Quick	No	6	51.0	635	160
RMS <i>Titanic</i>	British	1912	Collision	North Atlantic, Canada	Slow	Yes	5	35.2	1,496	712
RMS <i>Empress of Ireland</i>	British	1914	Collision	St. Lawrence River, Canada	Quick	No	2	38.2	983	465
RMS <i>Lusitania</i>	British	1915	Torpedoed	North Atlantic, United Kingdom	Quick	Yes	6	39.0	1,190	768
SS <i>Principessa Mafalda</i>	Italian	1927	Technical	Atlantic Ocean, Brazil	Slow	No	7	27.0	309	877
SS <i>Vestris</i>	British	1928	Weather	Atlantic Ocean, United States	Slow	No	2	33.6	125	183
SS <i>Morro Castle</i>	US	1934	Fire	Atlantic Ocean, United States	Slow	No	3	60.4	130	412
MV <i>Princess Victoria</i>	British	1953	Weather	North Channel, United Kingdom	Slow	No	1	20.2	135	44
SS <i>Admiral Nakhimov</i>	Russian	1986	Collision	Black Sea, Ukraine	Quick	No	1	47.9	423	820
MS <i>Estonia</i>	Estonian	1994	Technical	Baltic Sea, Finland	Slow	No	2	47.4	852	137
MS <i>Princess of the Stars</i>	Philippine	2008	Weather	Philippine Sea, Philippines	Slow	Not known	2	49.6	791	59
MV <i>Bulgaria</i>	Russian	2011	Weather	Volga, Russia	Quick	Not known	1	47.7	110	76

Duration indicates whether the ship sank quickly or slowly. WCF order indicates whether the captain gave the WCF order. (In the analysis, *no* and *not known* are treated as if the order was not given.) Voyage refers to the number of calendar days between departure and the sinking.

follow procedures and leave the ship after the passengers, we expect them to suffer a survival disadvantage compared with passengers. However, crew members are familiar with the ship, often have emergency training, and are likely to receive early information about the severity of the situation. We, therefore, expect the crew to have a relative survival advantage if they try to save themselves rather than assisting the passengers. Evidence from the *Titanic* suggests that crew members indeed have a significant survival advantage over passengers (11).

The third hypothesis (H3) is that the survival rate of women, relative to that of men, improves when the captain orders WCF. The potentially important role of the captain has largely been overlooked in previous studies. Evidence of people helping each other is not necessarily evidence of other-regarding preferences, or social norms, governing behavior. It has been shown, both theoretically and experimentally that people, who would not otherwise do so, may comply with a social norm if violation is threatened with punishment (22–24). Unlike other types of catastrophes, e.g., earthquakes, tsunamis, and terrorist attacks, a maritime disaster is characterized by the presence of a well-defined leader. On board a ship, the captain is the commanding officer with the supreme power to give and enforce orders. In the evacuation of the *Titanic*, the captain ordered WCF (25) and officers were reported to have shot at men who disobeyed the order (26). The situation on the *Titanic* resonates with the

situation in a third-party punishment game (TPPG), in which threat of punishment is necessary for self-regarding players to transfer resources to other players (22). Similar to the TPPG, in which punishment is costly, the WCF order comes at a cost for the captain because with the order he agrees to remain on board the ship until all women and children have been rescued. When the captain does not order priority to women, the situation resembles the allocation problem of a standard dictator game (27, 28), in which self-regarding players comply with norms only if the cost of the social stigma of violation exceeds the cost of compliance.

The fourth hypothesis (H4) is that women fare worse, relative to men, when the ship sinks quickly. It has been suggested that time is of critical importance for norms to guide behavior (11). When a ship sinks quickly, human actions are driven by hormonal reactions, such as a rapid increase of adrenaline, and selfish behavior should dominate. Evidence in favor of this argument rests on a comparison of the slowly sinking *Titanic* and the quickly sinking *Lusitania*. If a shipwreck is to be considered quick or slow depends on the size of the ship as well as the number of people on board the ship. Consequently, we define a shipwreck as *quick* if the ship sank in less than X minutes, where we let X be proportional to the size of the ship's complement. For a ship of the average size in our sample (686 passengers and crew) $X = 30$ min. See *SI Appendix, A* for a detailed description of how *quick* is defined.

The share of women among the passengers may have important implications for helping behavior among men. Giving priority to women comes at a cost for the men, as they lose valuable time in abandoning the ship and securing a lifeboat seat. This cost is lower when there are fewer women on board the ship, suggesting that behavior in line with the WCF norm will be more prevalent in shipwrecks with relatively few women. On the other hand, men have been shown to be more inclined to take risk in the presence of women (29), suggesting that the presence of relatively few women may make men less inclined to display chivalry. As the fifth hypothesis (H5), we posit that the survival rate of women improves, relative to that of men, when they constitute a comparably small share of the total number of passengers (below the sample mean of 36.8%).

The sixth hypothesis (H6) is that the survival rate of women improves, relative to that of men, if the voyage lasted for more than 1 d before the disaster. The premise is that longer time on board the ship will lead to more social interactions and increase social proximity by reducing anonymity between people, formation of networks, and strengthening of group cohesion. This, in turn, increases the likelihood that helping behavior is governed by social norms (30–32). Similarly, social proximity is likely to be higher on ships with a more intimate atmosphere. We, therefore, also test an alternative formulation of H6, H6.1, that the relative survival rate of women is higher when the ship is small (carrying fewer people than the average-sized ship in the sample, 686 people).

Whereas norms vary over time and space, it has been a grand challenge for scientists to understand when, where, or how norms develop, strengthen, or wane (33–35). It is possible that chivalry at sea was a common phenomenon in the 19th and early 20th century and that the fates of women were determined by men. With the rise of more sex-equal societies, however, women may have become more capable of surviving on their own. For instance, improved swimming skills as well as less restrictive clothing may have increased the survival prospects of women. World War I has been seen as a paradigmatic shift in the general view of manliness and the role of women in society (36). If H1 is true, but the strength of the WCF norm has weakened over time, we expect the survival advantage of women to be lower after World War I. However, if H1 is false, and women have a survival disadvantage compared with men, we expect the disadvantage to be smaller after World War I, as women have become more capable of surviving on their own. In both cases, we expect the survival rates of men and women to have converged. The seventh hypothesis (H7) is that the survival difference between men and women is lower after World War I.

Helping behaviors differ between cultures (34). Such differences may be present in maritime disasters involving ships with passengers and crew of different nationalities. Previous research on sex differences in survival has focused solely on British shipwrecks. Chivalry at sea has been seen as a defining characteristic of Britishness (36). If the expected stigma of norm violation is more severe for British men than for men of other nationalities, we expect higher compliance with the WCF norm on board British ships. The captains are British on all British ships in our sample; likewise crew and passengers are dominated by Britons on these ships. Our eighth and final hypothesis (H8) is that women fare better, relative to men, in maritime disasters involving British ships than in shipwrecks of other nationalities.

Results

Because the hypotheses have been derived mainly from evidence from the *Titanic* disaster (and to some extent from the *Lusitania*), we focus primarily on the 16 previously uninvestigated shipwrecks, data that we label as our main sample (MS). We denote the full sample including all shipwrecks in our data FS. Fig. 1 displays that, in the MS, crew members have the highest survival rate, followed by captains and male passengers, whereas

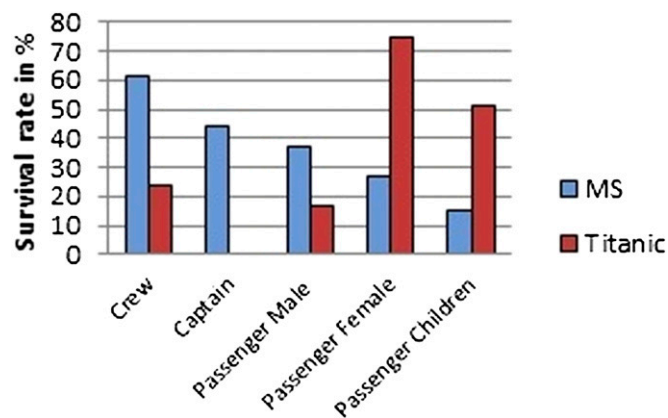


Fig. 1. Survival rates of passengers and crew. Survival rates of children are only available for nine shipwrecks in MS. See *SI Appendix, B, Tables S2 and S3* for the statistics underlying this figure.

the lowest survival rates are observed for women and children. This pattern stands in sharp contrast to the pattern observed for the *Titanic*.

We use regression analysis to study determinants of survival in shipwrecks. The shipwrecks are analyzed both in separate regressions and in regressions based on pooled data including all of the shipwrecks. The separate analyses of the shipwrecks allow us to test only H1 and H2. The advantage of these tests, however, is that they are methodologically comparable to previous tests conducted on data from the *Titanic* and the *Lusitania*. The regression analyses of the pooled data make it possible to control for unobservable shipwreck-specific circumstances and to test all eight hypotheses.

The first hypothesis (H1) is that women have a survival advantage over men in maritime disasters. In the separate analyses of all of the shipwrecks (FS) we find that women have a survival advantage ($P < 0.01$) over men in only 2 of the 18 disasters: the *Birkenhead* and the *Titanic*. For 11 of the shipwrecks, we find that women have a survival disadvantage ($P < 0.01$) compared with men. For the remaining 5 shipwrecks, we find no clear evidence of survival differences between men and women.

If crew members try to save themselves rather than assisting the passengers, we expect them to have a survival advantage over passengers (H2). Indeed, we find that crew members have a relative survival advantage ($P < 0.01$) in 9 of the 18 disasters. For the remaining 9 shipwrecks, we find no clear evidence of survival differences between crew and passengers. In addition to the *female* and *crew* variables, we augment the regressions with control variables for characteristics that are likely to affect the individual's chances of surviving in a shipwreck, such as age, ticket class, etc. The estimated impacts of those characteristics show that prime aged adults have a survival advantage over children and older persons and that there is a class gradient in survival benefitting first class passengers. Moreover, we find a survival disadvantage for passengers traveling as part of a group and that passengers and crew of the same nationality as the ship have no survival advantage over persons of other nationalities. (For detailed results, see *SI Appendix, B, Tables S4 and S5*.)

To take full advantage of the data, we present results from analyses, including all shipwrecks of the MS in each regression. To control for unobservable factors that vary between ships, but affect the survival chances of everybody on board each ship equally, such as e.g., severity of the disaster and weather conditions, we estimate regressions that include shipwreck-specific fixed effects (37). Table 2 reports the tests of each of the eight hypotheses (columns 1–8) as well as a joint test of all of the hypotheses together in one regression (column 9). For results of

Table 2. Determinants of survival in maritime disasters

Main hypothesis tested	H1	H2	H3*	H4*	H5*	H6*	H7*	H8*	H1–H8*
	1	2	3	4	5	6	7	8	9
Female	-0.167 (<0.001)	-0.126 (<0.001)	-0.151 (<0.001)	-0.151 (<0.001)	-0.116 (<0.001)	-0.154 (<0.001)	-0.195 (<0.001)	-0.093 (<0.001)	-0.179 (0.009)
Crew		0.187 (<0.001)	0.157 (<0.001)	0.157 (<0.001)	0.157 (<0.001)	0.157 (<0.001)	0.158 (<0.001)	0.159 (<0.001)	0.161 (<0.001)
Female interacted with WCF order			0.019 (0.477)						0.096 (0.019)
Quick				0.005 (0.806)					0.032 (0.452)
Small share of women					-0.109 (<0.001)				-0.050 (0.104)
More than one day voyage						0.006 (0.807)			0.026 (0.443)
Post World War I							0.085 (<0.001)		0.073 (0.074)
British ship								-0.153 (<0.001)	-0.101 (0.002)
Constant	0.346 (<0.001)	0.325 (<0.001)	0.244 (<0.001)	0.237 (<0.001)	0.111 (<0.001)	0.229 (<0.001)	0.329 (<0.001)	0.435 (<0.001)	0.471 (<0.001)
Observations	10,978	10,976	10,976	10,976	10,976	10,976	10,976	10,976	10,976
R ²	0.249	0.270	0.242	0.242	0.244	0.242	0.244	0.247	0.248

Linear probability models. The dependent variable (survival) is binary and equals 1 if the person survived the disaster and 0 if the person died. Coefficients are followed by *P* values, based on robust SEs, in parentheses. All models include shipwreck-specific fixed effects. Because WCF order, quick, small share of women, more than one day voyage, post World War I, and British ship do not vary within ships, observations in these regressions are weighted by the inverse of the number of individuals on board the ship to give all ships equal weight. Complete regression results, as well as results from unweighted regressions and regressions including the *Lusitania* and the *Titanic* can be found in *SI Appendix, B, Table S6–S14*.

*These regressions also include the binary indicators, which the female variable is interacted with.

samples including the *Lusitania* and the *Titanic*, see *SI Appendix, B*. The results in column 1 show that the survival rate of women is 16.7 percentage points lower than, or about half of (17.9 vs. 34.6%) that of men. The results in column 2 show that crew members are 18.7 percentage points more likely to survive than passengers. The finding that women have a large survival disadvantage compared with men, and that crew members have a survival advantage over passengers, holds true throughout the specifications in columns 3–9, and also with the inclusion of data from the *Lusitania* and the *Titanic*.

We find some evidence that the survival rate of women, relative to that of men, improves when the captain orders WCF. Because the WCF order was given on only five ships, including the *Lusitania* and the *Titanic*, MS is not ideal for testing this hypothesis. Nevertheless, the joint, and most reliable, test (column 9) indicates that the relative survival rate of women improves by 9.6 percentage points when the captain orders WCF. The result is strengthened when the *Lusitania* and the *Titanic* are included in the analysis.

The results give no support for H4 (that women fare worse, relative to men, when the ship sinks quickly, compared with when the disaster evolves more slowly). Women have a disadvantage independently of whether the ship sinks quickly or slowly.

The separate test of H5 (column 5) suggests that women fare worse rather than better, relative to men, when there are comparably few women among the passengers. However, the coefficient is statistically insignificant in the joint test (column 9) and when we include the *Lusitania* and the *Titanic*.

Contrary to H6, we do not find evidence that the relative survival rate of women improves if the voyage lasts for more than 1 d before the disaster. The coefficient estimates are close to zero and statistically insignificant in both specifications (columns 6 and 9). This finding also holds true for the alternative test of this hypothesis (H6.1), i.e., when we test whether women fare

relatively better in shipwrecks involving ships with comparably few people on board (*SI Appendix, B, Table S14*).

The results in columns 7 and 9 indicate that the survival rate of women, compared to that of men, is 8.5 and 7.3 percentage points higher after World War I. The finding that the relative survival rate of women has improved after World War I holds also with the inclusion of the *Lusitania* and the *Titanic*.

In contrast to H8, the results show that women fare relatively worse, not better, in shipwrecks involving British ships. The average survival rate of women on board British ships is estimated to be 15.3 (column 8) and 10.1 (column 9) percentage points lower than in disasters involving ships of other nationalities. Although being less strong, the effect remains also with the inclusion of data from the *Lusitania* and the *Titanic*. We note that the WCF order is given more often on board British ships. However, we find a larger survival disadvantage for women on British-dominated ships even when controlling for whether or not the WCF order has been given (column 9).

Discussion

Our results provide unique insights about human behavior in life-and-death situations. On the *Titanic*, the survival rate of women was more than three times higher than the survival rate of men (11). By investigating a much larger sample of maritime disasters than what has previously been done, we show that the survival rate of women is, on average, only about half that of men. We interpret this as evidence that compliance with the WCF norm is exceptional in maritime disasters. That women fare worse than men has also been documented for natural disasters (38–42). We also find that crew members have a higher survival rate than passengers and that only 9 of 16 captains went down with their ships. Children appear to have the lowest survival rate.

Moreover, we shed light on some common perceptions of how situational and cultural conditions affect the survival of women. Most notably, it seems as if it is the policy of the captain, rather

than the moral sentiments of men, that determines whether women are given preferential treatment in shipwrecks. This finding suggests an important role for leaders in disasters. Preferences of leaders seem to have affected survival patterns also in the evacuations of civilians during the Balkan Wars (43). In contrast to previous studies, we find no association between duration of the disaster and the influence of social norms. Furthermore, women do not appear to benefit from constituting a small share of the passengers. Neither do we find that contextual factors, which are likely to reduce social distance on board the ship, such as the length of the voyage and the size of the complement, influence the survival rate of women. Moreover, we find that the sex gap in survival rates has decreased since World War I. This supports previous findings that higher status of women in society improves their relative survival rate in disasters (41). We also show that women fare worse, rather than better, relative to men in maritime disasters involving British ships. This contrasts with the notion of British men being more gallant than men of other nationalities. On the basis of our analysis, it becomes evident that the sinking of the *Titanic* was exceptional in many dimensions and that what happened on the *Titanic* seems to have spurred misconceptions about human behavior in disasters.

Methods

Data. Starting from the list *Some Notable Shipwrecks since 1854*, published in the 140th Edition of *The World Almanac and the Book of Facts* (44), we have selected shipwrecks involving passenger ships that have occurred in times of peace, and for which there are passenger and crew lists containing

information on the sex of survivors and descendants separately. We limit the sample to shipwrecks involving at least 100 persons and in which at least 5% survived and 5% died. We have added data for one shipwreck occurring before 1854, HMS *Birkenhead* (1852), because it is often referred to as giving rise to the expression, women and children first: a notion that first became widespread after the sinking of the *Titanic* (36). Data for two shipwrecks that have taken place after 2006 are added: MS *Princess of the Stars* (2008) and MV *Bulgaria* (2011). Despite it being a wartime disaster, we also include data from the *Lusitania* (1915) in the sample, as it has been investigated in previous research. For details about the data, see *SI Appendix, A*. The data reported in this paper are available in *Dataset S1*.

Analytic Method. We test the hypotheses (H1–H8) by estimating linear probability models. The unit of analysis is the individual passenger or crew member. The dependent variable (survival) is binary and equals 1 if the person survived the disaster and 0 if the person died. The independent variable of main interest is the binary variable, female (females = 1, males = 0). A positive (negative) coefficient implies that women have a higher (lower) survival rate than men. Crew status is indicated by the binary variable crew (crew = 1, passengers = 0). For details on coding of variables, see *SI Appendix, A* and for model specification see *SI Appendix, B*.

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