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# Violence Involving Sailors: approaches for reducing the rates of violence

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**Violence Involving Sailors: Approaches for reducing the rates  
of violence**

by

Dr. Gregory V. Cox

Dr. Cynthia L. King

1 May 2006

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Prepared for: The Commander Third Fleet

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# Contents

<b>1.0 Introduction and summary .....</b>	<b>1</b>
1.1 Summary of key findings.....	1
1.2 Recommendations for Commander, THIRD Fleet .....	2
<b>2.0 Framing the anti-violence issues for Navy leadership .....</b>	<b>4</b>
2.1 Strategic level involvement.....	4
2.2 Operational level involvement.....	5
2.3 Tactical level involvement.....	6
<b>3.0 Analysis and key findings.....</b>	<b>7</b>
3.1 Tracking reported numbers of incidents is a poor assessment metric .....	7
3.1.1 Absolutely large and relatively small numbers.....	8
3.1.2 Database discrepancies .....	8
3.1.3 Practical reasons for inaccurate and incomplete data .....	10
3.1.4 Operational level implications .....	11
3.2 Young sailors are more susceptible to violence.....	11
3.2.1 Demographics matter .....	12
3.3 Alcohol misuse is a significant contributing factor .....	14
3.4 Leadership communications about violence in the Navy matters .....	15
3.4.1 Venue, frequency, and circumstances surrounding communication .....	16
3.4.2 Leaders: A broad term .....	18
3.4.3 Sincerity and credibility of leaders .....	20
3.4.4 Communication techniques for training.....	20
3.5 Other factors related to incidents of violence .....	21
3.5.1 Pattern recognition approach .....	22
3.5.2 Is tempo related to incidents of violence?.....	25
3.5.3 Do interdeployment phases affect incidents of violence?.....	27
3.5.4 Does the change of deployment status affect incidents of violence?.....	29
3.5.5 Does the time of year affect incidents of violence?.....	29
3.5.6 Does the homeport affect the incidents of violence? .....	30
3.5.7 Do certain Naval policies affect incidents of violence?.....	32
3.5.8 Are post-9/11 incidents of violence different than pre-9/11? .....	35

3.5.9 Other possibilities not analyzed .....	36
<b>4.0 Future efforts.....</b>	<b>37</b>
<b>Appendix. Pattern recognition tutorial.....</b>	<b>42</b>
A.1 Pattern recognition of clearly separable populations .....	42
A.2 Pattern recognition of marginally separable populations.....	44
A.3 Pattern recognition of statistically identical populations .....	46
<b>INITIAL DISTRIBUTION LIST .....</b>	<b>48</b>

## List of Figures

Figure 1. Reports of sexual assaults from three different Navy data sources.....	9
Figure 2. Incidents of violence in comparison with Navy paygrade demographics .....	13
Figure 3. Incidents of violence in comparison with Navy age demographics .....	13
Figure 4. Representative sample from SITREP spreadsheet .....	22
Figure 5. Three operating curves, for three different population pairs .....	24
Figure 6. Historical deployment lengths for aircraft carriers.....	25
Figure 7. <i>LINCOLN</i> versus other west coast carriers .....	26
Figure 8. Maintenance versus non-maintenance periods .....	28
Figure 9. “Holiday months” versus the rest of year.....	29
Figure 10. SURFPAC homeport of San Diego versus others.....	31
Figure 11. AIRPAC homeport of San Diego versus others .....	31
Figure 12. <i>Sea Swap</i> combatants versus other CRUDES .....	33
Figure 13. <i>BOXER</i> (OME) versus other LHAs/LHDs.....	34
Figure 14. Pre 9/11 versus post 9/11.....	35
Figure 15. IDC&R main page.....	38
Figure 16. Drop-down menu selection in IDC&R tool.....	39
Figure 17. Drop-down sub-menu in IDC&R tool.....	39
Figure A-1. Scatter-plot that distinguishes two clearly separable populations.....	43
Figure A-2. Operating curve that distinguishes two clearly separable populations .....	44
Figure A-3. Scatter-plot that distinguishes two marginally separable populations .....	45
Figure A-4. Operating curve that distinguishes two marginally separable populations ..	46
Figure A-5. Scatter-plot for two statistically identical populations.....	47
Figure A-6. Operating curve for two statistically identical populations.....	47

## **List of Tables**

Table 1. Alcohol involvement in incidents of violence involving sailors .....	15
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## 1.0 Introduction and summary

With approximately 360,000 sailors and officers on active duty, the U.S. Navy is roughly equivalent to Miami or St. Louis in terms of sheer number of people. At this size, it is predictable that there will be daily incidents of violence that involve sailors – incidents where sailors are perpetrators and incidents where sailors are victims. These incidents span the spectrum of violence, from emotional and verbal abuse, to physical and sexual assault, to homicide and suicide.

Violence involving sailors will continue to be a reality for the Navy, but there should be additional steps that the Navy can take to reduce the incidence of violence, just as major cities such as Miami and St. Louis adopt policies that reduce their crime rates. The question for Navy leadership is *what?* What effective steps can be taken that will significantly reduce the quantity, and severity, of violence involving sailors?

Our specific focus is the Navy's THIRD Fleet, whose area of responsibility includes the western coast of the Continental United States, as well as Alaska and Hawaii, where hundreds of Navy ships, submarines, and aircraft are based. We set out to investigate four broad questions related to violence involving sailors, on the premise that insights gained could be translated into actionable steps that Navy Commanders could take to reduce the quantities and severity of violence involving sailors:

- Do incidents of violence involving sailors vary with time or place? For example, are characteristics of violence different during long-term maintenance than during at-sea workups? Or are the characteristics of violence different in San Diego than in Everett/Bremerton?
- Do incidents of violence involving sailors vary with Naval policies? For example, are the characteristics different under the Optimal Manning Experiment (OME) than under normal manning policies?
- Do incidents of violence involving sailors vary with the tension of the global situation? For example, are the characteristics of post-9/11 violence different than the pre-9/11 characteristics?
- How do sailors perceive leader communication regarding violence? In other words, what do leaders say, what do sailors hear, and how much does leadership really matter?

### 1.1 Summary of key findings

There are many recorded incidents of violence involving sailors, but there is substantial evidence that there are many more incidents that go unreported by the victims. Therefore, perceived increases and decreases in violent incidents are just that – perceptions. It may make sense to look at long-term trends in violent behavior, but short-term trends are beyond the meaningful measurement capacity of current records.

Nonetheless, the data tell us certain things. For example, after accounting for the demographic distribution of active-duty service members, we find that sailors in paygrades of E3 to E5 are disproportionately more likely to be perpetrators of violence

than those in other paygrades. Coupled with the relatively-large overall population of active-duty sailors in these paygrades, we see that most acts of violence are found in this relatively narrow sector of the Navy.

Our data on the co-involvement of alcohol in violent data were incomplete, but among the incidents where we had data we found roughly the same number of incidents involved alcohol as those that did not. This suggests that approximately half of the violent incidents also involve alcohol misuse or abuse. Conversely, this suggests that approximately half of the violent incidents do not involve alcohol.

We conducted a pilot study to see how leadership and communications affect behavior. This study involved interviews, focus groups, and other discussions with both enlisted sailors and officers. Although to our knowledge the discussions were with those who had *not* been involved in violent incidents, we gained insights and appreciation for how sailors perceive the communicated messages regarding violence. Communication about this topic does matter, and the context in which that communication takes place also matters. This provides a challenge, and an opportunity, for Navy leadership at all levels, from Commanding Officers to Petty Officers.

Finally, we applied a statistical technique to a set of recorded incidents of violence to identify other factors that correlate with violence. We found some degree of correlation between violence and (i) operational/personnel tempo, (ii) phase of interdeployment cycle, and (iii) possibly the location of the homeport. However, we found very little correlation between violence and (i) time of year,<sup>1</sup> (ii) novel manning initiatives such as *Sea Swap* or *Optimal Manning Experiment*, and (iii) the time period before 9/11 and the time period after 9/11.

## 1.2 Recommendations for Commander, THIRD Fleet

We provide clearly-marked operational level implications throughout this report. Each of those implications forms the basis for one of recommendations below.

**Recording violent incidents:** Develop a common requirement for reporting data, and a common standard for reporting them, through a common user-friendly tool, coupled with common user training.

**Focused prevention measures:** Target the E3 – E5 paygrades for enhanced violence-prevention measures. A natural approach is to convey enhanced leadership expectations of sailors as they are promoted from seaman (E3) to petty officer (E4).

**Alcohol and violence:** Give equal attention to preventing alcohol misuse and to preventing violence.

**Effective communications:** Ensure that policies are well understood. Conduct frequent discussion and clarification of the policies. Perceptions of fairness of the policies and the severity of punishments are less important than “staying on message.” The discussions

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<sup>1</sup> This is surprising because common wisdom tells us that there are more stresses during annual holiday seasons. An alternative interpretation is that the current measures that the Navy invokes to ease those stresses are effective.

must be genuine because sailors will attribute the priority to the topic that they *perceive* the command leadership holds.

**Leadership:** Empower and demand that all leaders, from E4 to O9, fulfill the responsibilities that they have in violence prevention. Sincerity and credibility matter in the eyes of sailors. They hear the words, but also look at the actions.

**Training:** Ensure that presentations on violence prevention and recovery have a story to tell, presented in an environment where it is clear that senior leadership cares about the subject.

**Tempo:** Require that units undergoing high OPTEMPO take additional anti-violence precautions.

**Phase of non-deployed cycle:** Require that units disseminate violence-prevention messages prior to each major change in phase.

**Holiday stress:** Continue with current holiday-related policies of discussing violence prevention.

**New manning concepts:** New policies such as *Sea Swap* and OME have many far-reaching impacts, but they do not appear to alter the characteristics of incidents of violence. Nonetheless, continue to monitor these units for violence characteristics.

## 2.0 Framing the anti-violence issues for Navy leadership

There are two dimensions to the issues of violence involving sailors and both of these are widely understood and appreciated:

- Prevention: What (additional) steps can be taken to keep violence involving sailors from happening?
- Recovery: If the incident has already happened, what (additional) steps can be taken to enable a more robust recovery?

This report is focused almost exclusively on the first dimension, prevention, but we would be remiss to overlook the second. In addition to the moral imperative for seeking effective recovery approaches, the effectiveness of those approaches should have a positive impact on the preventative measures by reducing the incidents of repetitive events.

These policies and measures can be reduced to three categorical levels that we denote by strategic, operational, and tactical, corresponding to the translation from general goals to practical implementation. The demarcations between these levels are not exact, and each commander will have some role to play in all three levels, just as they do in warfare with its strategic, operational, and tactical levels. However, the categorization can help commands focus on expectations from higher headquarters, and responsibilities to subordinates.

### 2.1 Strategic level involvement

Strategic level policies set the tone and direction for the Navy (or DOD as a whole), but do not immediately translate into actionable steps that individuals, or even most commands, can execute. Instead, these policies set the guidance for the next level of involvement. Examples of strategic level involvement, specifically related to domestic violence, are:

- Defense Task Force on Domestic Violence (DTFDV), which made the following broad (strategic level) recommendations.<sup>2</sup>
  - Culture Shift: Create a military culture that does not tolerate domestic violence.
  - Victim Advocate Program: Create a strong Victim Advocate Program.
  - Domestic Violence Intervention Process Model: Implement a domestic violence intervention process model.
  - Assessment and Intervention Teams: Create new Domestic Violence Assessment and Intervention Teams.
  - Fatality Reviews: Create a fatality review process.

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<sup>2</sup> Defense Task Force on Domestic Violence (DTFDV): Initial Report of the DTFDV, February 2001; Second Year Report of the DTFDV, February 2002; Third Year Report of the DTFDV, February 2003.

- Training and Prevention Programs: Implement institution-wide training and prevention programs.
- Collaboration Between Military and Civilian Communities: Ensure cooperative relationships between military and civilian organizations.
- Evaluation: Continuously evaluate the results of its domestic violence prevention and intervention efforts.
- Memo from the Deputy Secretary of Defense, demanding that military service leaders take appropriate steps to curtail the levels of domestic violence.<sup>3</sup> In that memo, he forcefully stated:
  - Domestic violence will not be tolerated in the Department of Defense.
  - Domestic violence is an offense against the institutional values of the Military Services of the United States of America.
  - Commanders at every level have a duty to take appropriate steps to prevent domestic violence, protect victims, and hold those who commit it accountable.

## 2.2 Operational level involvement

Following top-level guidance and broad recommendations from senior advisory boards, the challenges move to the operational level of involvement, where implementation begins. This is the level where most flag officers, including Commander, THIRD Fleet, will operate.

Operational level policies are directed at organizations, rather than individuals, but could nonetheless be carried out by commanding officers or other mid-level echelons of command. The challenge at this level is to go beyond directing that something must be done, and begin to translate that direction into specific programs or actions. Some examples:

- Message from VCNO urging Navy leaders to take immediate personal actions to staunch an apparent trend of hazing.<sup>4</sup> Coming from the VCNO, the message has a strategic-level flavor to it. However, he offered some specific guidance that allows it to be considered at the operational level:
  - Immediate superiors must work to uphold conduct standards in their subordinate commands.
  - Assess command climates to ensure that they meet or exceed expectations.
  - Prompt leadership at all levels to reengage sailors and actively control the circumstances that would lead to incidents.

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<sup>3</sup> Paul D. Wolfowitz, Deputy Secretary of Defense, Memo, 19 November 2001.

<sup>4</sup> Reported in CHINFO News Clips, *End it now, Vice CNO tells Navy bosses*, 20 June 2005.

- Message from OPNAV (N1) directing targeted training for sexual assault prevention,<sup>5</sup> specifying certain requirements for training:
  - Sexual assault training should be provided upon a sailor's initial entry to a command.
  - Sexual assault training should be continued on a recurring basis.
  - Sexual assault training should be integrated with other leadership development programs.
- Message from Commander, Seventh Fleet, outlining initiatives designed to ensure proper behavior in the politically sensitive Seventh Fleet area of responsibility.<sup>6</sup> Those initiatives include:
  - Liberty Card Program, designed to assist at-risk junior sailors.
  - Civilian Clothing Policy, setting the tone for sailors on liberty.
  - Liberty Risk Program, a preventative measure to assess potential for future misconduct.
  - Education Programs, to address alcohol and substance abuse.
  - Buddy System Enforcement, to significantly reduce the chances for misconduct.

The operational level of involvement also sets the framework for much of the tactical level. It is therefore crucial that operational level policies have a firm understanding of the interactions at the next level.

### **2.3 Tactical level involvement**

The tactical level is where interactions with individuals take place. Established programs such as the Family Advocacy Program (FAP) are implemented at the tactical level. Commanding Officers and Command Master Chiefs play a major role in tactical execution of these policies but all officers, commissioned and non-commissioned, have a significant role to play.

Examples of tactical level violence-prevention measures include:

- Posted statements by Commanding Officers, articulating command policies on matters such as hazing, sexual assault, or domestic violence.
- Periodically communicated messages, articulating expectations and requirements for individual behavior.
- Training that is specific to violence awareness and prevention.
- FAP representatives at each command, for awareness and recovery support.

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<sup>5</sup> NAVADMIN message, 102244Z May 2005, *Implementation of DOD policy and program direction for prevention of, and response to, sexual assaults involving members of the armed services.*

<sup>6</sup> PFOR message, 220725Z April 2005, *Personal behavior in the Seventh Fleet AOR.*

## 3.0 Analysis and key findings

Our research included a broad review of relevant literature on the topic, as well as directed research of sociological and statistical dimensions. These key findings are discussed in the following sections:

- Numbers of reported incidents can be misleading, and policy revisions based upon increases or decreases in reported incidents are not recommended. Incomplete reporting is inevitable. Consistency in reporting is more important than completeness of reporting.
- All sailors are not equally likely to be involved in violence. Sailors in paygrades E3 – E5 are disproportionately more susceptible to involvement. Focused prevention measures make sense and there is a natural way to do this.
- Many incidents of violence also involve alcohol. Alcohol misuse should be addressed in the context of prevention of violence. Navy leadership on this topic must come through actions as well as words.
- Leadership and communications matter. Sailors listen to what commissioned and non-commissioned officers say, including non-verbal messages. Sometimes the offline and non-verbal messages contradict the online verbal ones.
- There are many other factors related to incidents of violence and some of them have measurable effects. However, none of them were found to have dominant effects.

### 3.1 Tracking reported numbers of incidents is a poor assessment metric

There are no good estimates for the number of incidents of violence, and any estimate should be viewed skeptically. The lack of good quantitative estimates presents a dilemma to Navy leadership. Following human nature, increases in the reported number of incidents often triggers a “cracking down” because of the perception that things are starting to get out of hand.<sup>7</sup> However, if the perception is caused by data biased from inconsistent reporting, rather than by a real trend, the cracking down may appear unwarranted by sailors who do not share the perception of the problem. They may simply not identify with the new sense of urgency that Navy leadership has adopted.

Bias in data sounds surreptitious, but it can be introduced unintentionally without ever realizing that it is happening. For example, through the lack of clear understanding of the differences between sexual harassment, indecent assault, sexual assault, and rape, there is inconsistent labeling of certain types of violent sexual acts. Bias arises if one command consistently reports incidents one way and another command consistently reports them a different way.<sup>8</sup> As another example, if alcohol involvement is unknown, it might be represented by one command as “unknown,” or it might be represented by another

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<sup>7</sup> An example of this is the June 2005 reaction to recently discovered cases of hazing at several units.

<sup>8</sup> If the inconsistency is within a single command, the statistical effect is “noise” instead of “bias.” Noise is easier to handle, statistically, than bias.

command as “none,” because none has been established. A more common introduction of data bias comes from different commanders that have different philosophies and thresholds for reporting the incidents.<sup>9</sup> The false effect of this is that one group of commands appears to have a disproportionate number of low-level incidents and another group of commands appears to have a disproportionate number of high-level violent incidents.

### **3.1.1 Absolutely large and relatively small numbers**

We know that the numbers of incidents of violence are large, even without good estimates. For example, there is general agreement that the number of military reports of domestic violence alone range from 20,000 to 23,000 per year, with at least half of them substantiated.<sup>10</sup> Because the U.S. Navy accounts for roughly a quarter of the total military population,<sup>11</sup> we would expect for there to be several thousand substantiated reports annually within the Navy.

Although large in absolute numbers, these 20,000 – 23,000 incidents are small (~1.5%) in relationship to the total military population that currently stands at over 1,400,000 people. Indeed, this relative rareness hampers our statistical examination of individual units, or even small groups of units. For example, over the period from FY 2000 – 2004, our database of SURFPAC SITREPs has only one recorded incident of violence for *USS CHOSIN* (CG 65), and none at all for *USS FLETCHER* (DD 992). We are thus led to examine the problem at higher levels of aggregation.

### **3.1.2 Database discrepancies**

Military leaders naturally want accurate accounting of violence incidents. Getting accurate data does not sound conceptually difficult. However, the evidence makes it clear that accurate data is not presently at hand. For example, Figure 1 comes from the recent Naval Inspector General report on sexual assault (one of many instances of violence).<sup>12</sup> The dominant feature of the graph is the variance – different data sources lead to vastly different estimates.

If taken literally, the discrepancies even give conflicting trends. Statisticians will point out that even with only one set of data and thus avoiding the inconsistencies, we usually cannot attribute statistical significance to the trend data. This may be factually true, but it is not very helpful to decision makers who don't want to wait until the problem is fully manifested before they take action.

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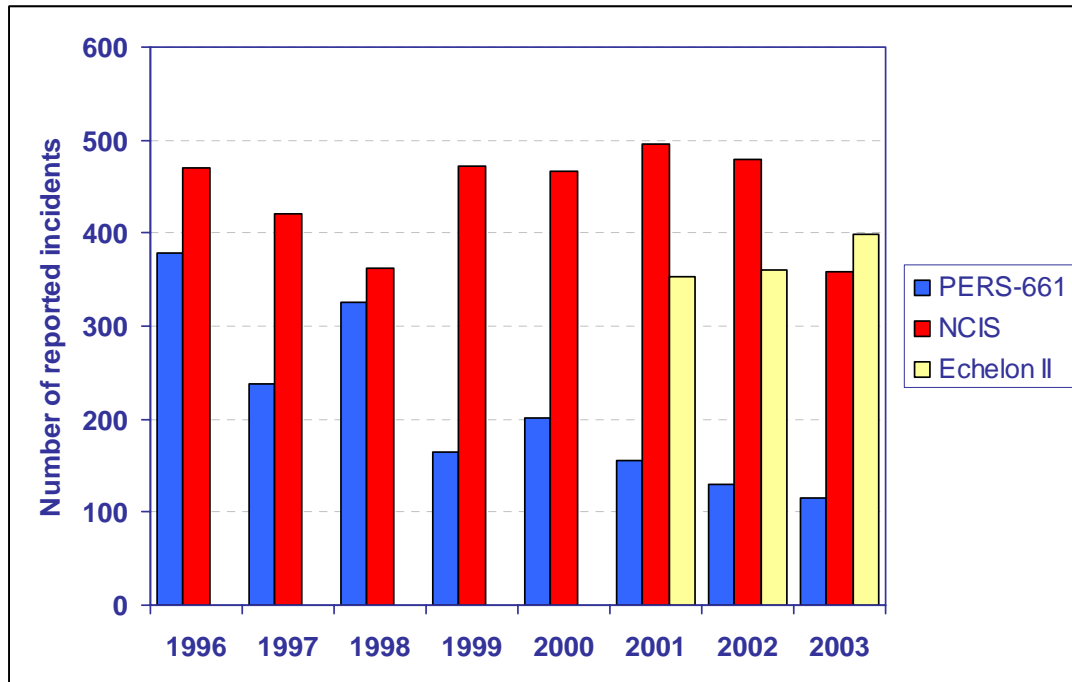
<sup>9</sup> The usual form of reporting comes in Unit Situation Reports, or SITREPs.

<sup>10</sup> Defense Task Force on Domestic Violence (DTFDV): Initial Report of the DTFDV, February 2001; Second Year Report of the DTFDV, February 2002; Third Year Report of the DTFDV, February 2003.

<sup>11</sup> Office of the Undersecretary of Defense, Personnel and Readiness, *Population Representation in the Military Services, FY 2003*.

<sup>12</sup> Naval Inspector General, *Sexual Assault Study Brief*, Spring 2005.





**Figure 1. Reports of sexual assaults from three different Navy data sources**

The inconsistency in the data of Figure 1 help illuminate the general difficulties with getting “accurate data.” There are three general approaches for resolving the inconsistencies, each with a significant set of problems:

- Start anew, and create an accurate database. This creates a fourth database, instead of the current three. There would have to be broad agreement that the fourth database was accurate and that the other three should be discarded, and getting that agreement would probably be difficult.
- Pick one of the existing databases, and scrub it until it is accurate. This presumes that scrubbing hasn’t been applied to the existing databases. Even with this, the other databases would have to be discarded.
- Work with the three (or possibly more) existing databases, scrubbing them all until they all agree and are all accurate. This would probably uncover some fundamental differences in assumptions, leading back to the first option of creating a new database.

Past attempts have been made to rectify some of these problems. For example, there was a CNO directive to NCIS, and its subordinate CLEOC (Consolidated Law Enforcement Operations Center), to standardize all incident reporting.<sup>13</sup> However, we found that CLEOC is significantly understaffed for this task, and relies on unit Masters at Arms to submit the reports for its database. If a unit (e.g., a submarine or an aircraft squadron)

<sup>13</sup> CNO message, 091530Z December 2003, *Consolidated law enforcement operations center (CLEOC) implementation*

doesn't have a Master at Arms, no reports will be filed with CLEOC. Thus CLEOC data is incomplete, and will continue to be under the present structure.

### 3.1.3 Practical reasons for inaccurate and incomplete data

The maxim applies: we don't know what we don't know. However, we do know that there is a lot that we don't know. For example, we know that a large number of incidents of violence, especially domestic violence, go unreported,<sup>14</sup> and that incidents that occur off base are more likely to go unreported than those on base.<sup>15</sup> A related CNA study found that domestic violence reported in unit SITREPS accounts for only 10 – 15 percent of the numbers reported by the local FAP.<sup>16</sup> These obstacles pose enormous challenges for getting complete data.

Because so many incidents of violence go unreported, a truly successful program would actually see an initial *increase* in the numbers of reported cases and thus an initial increase of the numbers in the database, because an effective overall approach must address recovery as well as prevention. Even though an increase in reported incidents may not really mean that the problem is getting worse, after-the-fact explanations would likely appear defensive and disingenuous. This implies that Public Affairs should be involved, to lead the discussion rather than responding to negative publicity.

Different estimates are sometimes associated with different criteria and assumptions, even among reported cases. For example, one report cites roughly 1,000 annual cases of sexual assault where the *victims* are in the military.<sup>17</sup> Yet this is less than half of those reported in another study.<sup>18</sup> Upon closer inspection however, the threshold for violence between the two studies are quite different, with the larger estimate corresponding to a lower threshold that includes emotional abuse, including an affirmative answer to the question: *Have you ever as an adult been emotionally abused by a husband, boyfriend, or female partner?*

Compounding these problems, some studies are performed by advocates who may adjust the thresholds to conform to their points of view. For example, it is difficult to discern whether incidents of violence in the military are statistically comparable to those in the

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<sup>14</sup> Caliber Associates, *Abuse Victims Study Final Report*, Arlington, VA, 1994

<sup>15</sup> Army Times, *Army must overcome aggression at home*, 12 August 2002

<sup>16</sup> Jennifer Ezring, *Relationship between domestic violence and deployment cycles*, Informal CNA paper, March 2005.

<sup>17</sup> Associated Press, *1700 military-related sex assaults reported*, by John J. Lumpkin. That report cites 901 cases in 2002, 1,012 in 2003, and 1,275 in 2004.

<sup>18</sup> Jacquelyn Campbell et al, *Intimate Partner Violence and Abuse Among Active Duty Military Women*, *Violence Against Women*, Vol. 9, No. 9, Sept 2003, pp. 1072-1092. The article cites an estimate of 21.6% of active duty military women victims, reported over the period from January 1998 to October 2000. We converted this percentage, using the FY 1999 reported number of active duty women in the military as 194,924. Amortizing this across a 20-year service equates to an annual rate of over 2,000. Amortizing over a shorter period would increase the annual rate.

civilian community or not, with some arguing that the military rates are much higher,<sup>19</sup> and others arguing that the rates are comparable.<sup>20</sup>

There are data entry errors in addition to these practical problems. In our data that were provided by the type commanders, we have cases of suspicious data that appear erroneous, but with no viable means for verification. Our experience is not unique; in an Army Times report of 1997 data, 39 reported *offenders* were listed as born between 1990 and 1998.<sup>21</sup> This also leads us to treat data in the aggregate, where we assume that these spurious errors are “unbiased noise” and do not significantly affect the overall trends.

### 3.1.4 Operational level implications

The problems of inaccurate and incomplete data remain, despite CNO-level attention. They persist because they are complex and defy simple solutions. Violence data is woefully incomplete, but a quest for complete data is neither realistic nor required for all analyses of trends. There are some analytical approaches that do not fundamentally depend on a completely accurate database as a starting point. While these approaches can tolerate incompleteness and some level of non-biased error (noise) in the database, they are sensitive to systemic bias that comes from inconsistent reporting that skews the overall trends. This suggests guidance for approaches that seek to improve the quality of data reporting. Among improvements in completeness, human errors, and inconsistency, the most critical is the elimination of inconsistencies.

**Operational level implication:** All improvements in data reporting are not equally important. Removing the systemic inconsistencies in reporting is more important than removing (random) human error. The focus should be on eliminating bias from inconsistent reporting, and accept that the data will be incomplete. To eliminate bias, a common requirement for reporting data, and a common standard for reporting them, must be enforced by all commands. A common user-friendly tool, coupled with common user training, is needed.

## 3.2 Young sailors are more susceptible to violence

It is intuitive and well known that the majority of incidents of violence involve enlisted sailors, not officers (commissioned or non-commissioned). For example, in a seminal report on abuse in the military,<sup>22</sup> Caliber Associates found that in cases of spousal abuse, 69% of the offenders were in paygrades E4 to E6, while only 2 percent were officers.

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<sup>19</sup> CBS News (60 Minutes), *The war at home*, 17 January 1999. The report said that, over the past five years, the number of spouses in the military that were subjected to domestic violence was almost five times higher than in the civilian population.

<sup>20</sup> Lauren R. Taylor, *The home front*, Government Executive, vol 34, Iss 3, pp 50-55. The article quotes Professor Richard Heyman, as saying that “if you control for demographic factors, the rates are very close.”

<sup>21</sup> Army Times, *Army must overcome aggression at home*, 12 August 2002

<sup>22</sup> Caliber Associates, *Abuse Victims Study Final Report*, Arlington, VA, 1994

### 3.2.1 Demographics matter

To put these percentages in the context of overall demographics of the Navy, we note that the percentages of combined military personnel in the paygrades of E4 to E6 constitute about 51% of the total force.<sup>23</sup> In view of this, these sailors that account for 69% of the total *spouse abuse* appear to be significantly more susceptible than other paygrades. In contrast, the Caliber study also found that in cases of *child abuse*, 49% of the offenders were in paygrades E4 to E6. In view of the overall demographics, it does not appear that this group of sailors is more prone to child abuse than other paygrades.

Data specific to the THIRD Fleet Area of Responsibility is slightly shifted from that reported by Caliber Associates, although our data includes all (reported) incidents of violence, not just domestic abuse. We see the most disproportionate levels arising at the E3 to E5 paygrades, across each of the major Navy communities: surface, aviation, and submarine.

Figure 2 plots Navy-wide demographics by paygrade, and then contrasts them with reported perpetrators of violence as reported by SURFPAC, AIRPAC, and SUBPAC. The solid lines give the demographics for FY 1997 – FY 2003,<sup>24</sup> showing almost no variation from year to year. Reported violence data from the three communities are overlaid on the graph, quantified as percentage of the reported incidents by paygrade.

Unfortunately, we do not have demographic data specific to the THIRD Fleet Area of Responsibility (AOR), leading us to use data for the Navy as a whole. While this may lead to an “apples and oranges” comparison, we believe that the message from the graph would be largely unchanged. A slightly different view of the data comes from sorting by age, rather than paygrade. In Figure 3, the spike is more pronounced, peaking with the 20-24 year old age bracket. However, it may still be preferable to focus on paygrade, because it is easy to tell the paygrade of a sailor, and somewhat harder to know his/her age.

**Operational level implication:** The Navy, including THIRD Fleet, should target certain paygrades for enhanced violence-prevention measures. A natural approach is to convey enhanced leadership expectations of sailors as they are promoted from seaman (E3) to petty officer (E4). This could be done in parallel with the overall training and indoctrination that accompanies such a promotion, and thus it would fit well within the existing personnel framework. As such, it would be a proactive (positive) approach rather than a reactive (negative) one.

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<sup>23</sup> This percentage is based on FY 1996, the date closest to the Caliber Associates report date for which we have data. However, this percentage has been relatively constant over the years, and is also reflective of FY 2003.

<sup>24</sup> Office of the Undersecretary of Defense for Personnel and Readiness, *Population Representation in the Military Services, Fiscal Years 1997-2003*. Data for FY 2004 have not yet been published.

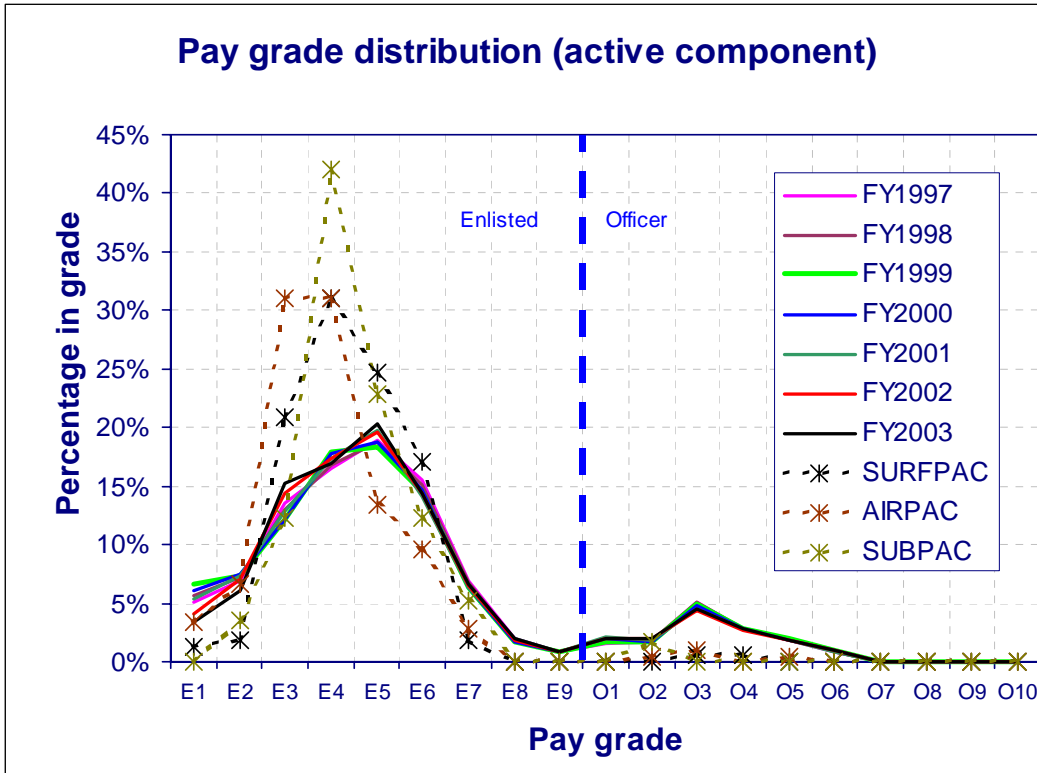


Figure 2. Incidents of violence in comparison with Navy paygrade demographics

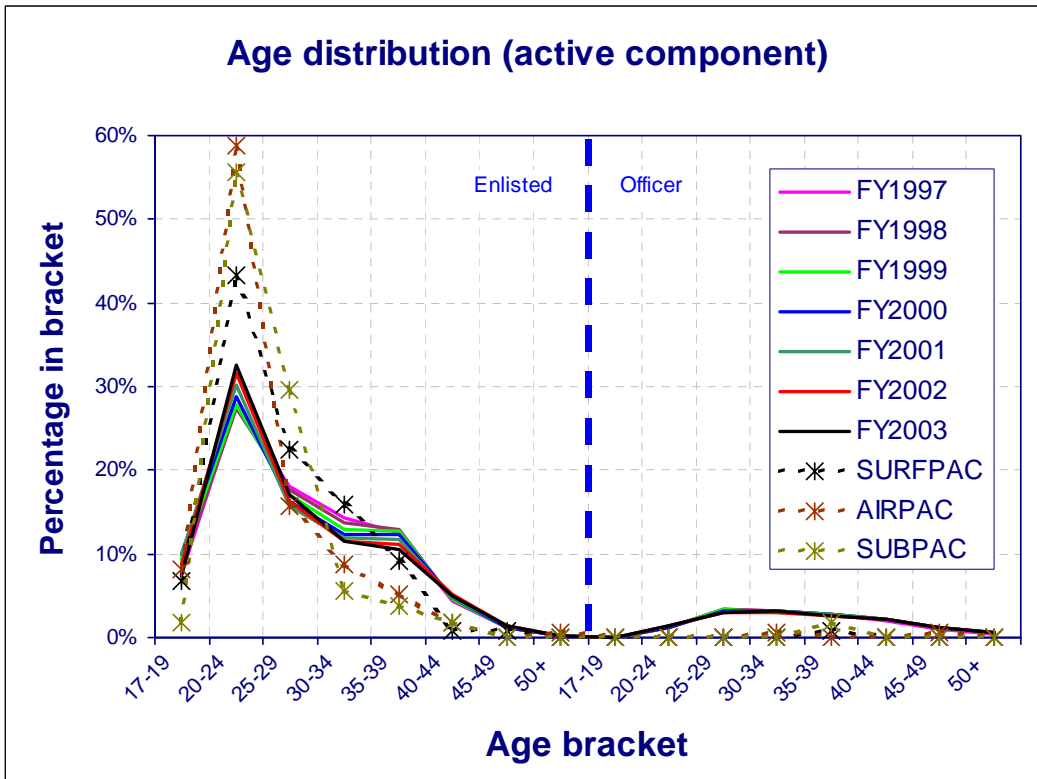


Figure 3. Incidents of violence in comparison with Navy age demographics

There is a similar effect seen in the limited data that we have from liberty incidents, some of which do not involve violence (e.g., automobile accidents).<sup>25</sup> Somewhat surprisingly, in the limited aggregated data, there appears to be a slight shift toward older sailors, with more liberty incidents associated with those in the 25-29 age bracket than in the 21-24 age bracket. However, the data from those liberty incident studies agree that the highest percentages of incidents occur at the paygrades of E3, E4, and E5 (in that order). This interesting difference strengthens our view that it is preferable to focus violence-prevention measures on paygrade rather than age.

### **3.3 Alcohol misuse is a significant contributing factor**

Incidents of violence involving sailors frequently occur in conjunction with the use of alcohol by the perpetrator, by the victim, or by both. This is neither surprising nor a new revelation. For example, the IG report on Sexual Assault reports that 40% of rape investigations reported the use of alcohol by the perpetrator, victim, or both.<sup>26</sup> In another study, one of intimate partner violence of married Army males,<sup>27</sup> alcohol was found to be the *most significant factor* in cases of moderate to severe cases of violence. Anecdotally, it would be unusual to overhear a sailor saying that he planned “to go slap around his girlfriend,” but not unusual to overhear one saying that he planned “to go get drunk.”

Although not restricted to violence *per se*, the two past studies that looked at liberty incidents for deployed ships found that alcohol was a factor in a large percentage of the cases (e.g., from 55% to 72% of the cases among the two reports), many of which involved violence.<sup>28</sup>

We find a similar relationship between incidents of violence and alcohol use among our databases that are specific to the THIRD Fleet AOR. Table 1 summarizes the data compiled by the type commanders, where alcohol involvement is cited in 23% to 43% of the incidents. The actual numbers could be significantly higher than shown in the table because the records tend to be dominated by the lack of definitive information. Indeed, we infer from the data in the table that roughly half of the incidents of violence also involve alcohol, on the presumption that the incidents in which alcohol involvement is not recorded are equally likely to involve alcohol as not.

In other words, there is a high degree of correlation between alcohol and violence. Nonetheless, violence is not a subordinate issue to alcohol misuse, for there remain many incidents of violence with no alcohol involvement.

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<sup>25</sup> Gregory M. Swider, *Liberty Incident Analysis*, Center for Naval Analyses CAB 99-30, May 1999; Daniel J. Whiteneck, *HSTBATGRU 2003-03 Deployment: Liberty Incident Data*, Center for Naval Analyses Informal report, 2003. Both of these reports are limited to the Sixth Fleet AOR.

<sup>26</sup> Naval Inspector General, *op cit*, 2005.

<sup>27</sup> Leora N. Rosen et al, *The Effects of Peer Group Climate on Intimate Partner Violence Among Married Male U.S. Army Soldiers*, *Violence Against Women*, vol 9, no 9, September 2003, pp 1045 – 1063.

<sup>28</sup> Gregory M. Swider, *op cit*, 1999; Daniel J. Whiteneck, *op cit*, 2003.

**Table 1. Alcohol involvement in incidents of violence involving sailors**

<b>Command</b>	<b>Alcohol involved by at least one involved</b>	<b>No alcohol involvement</b>	<b>Unresolved alcohol involvement</b>
Naval Surface Forces, Pacific (SURFPAC) 1Q FY 2000 – 4Q FY 2004	<b>23%</b> (112 of 484 incidents)	<b>35%</b> (171 of 484 incidents)	<b>42%</b> (201 of 484 incidents)
Naval Air Forces, Pacific (AIRPAC) 1Q FY 2003 – 4Q FY 2004	<b>28%</b> (103 of 371 incidents)	---	<b>72%</b> (268 of 371 incidents)
Naval Air Forces, Pacific (AIRPAC) 1Q FY 2005 – 2Q FY 2005	<b>38%</b> (80 of 209 incidents)	<b>28%</b> (59 of 209 incidents)	<b>33%</b> (70 of 209 incidents)
Naval Submarine Forces, Pacific (SUBPAC) 1Q FY 2003 – 2Q FY 2005	<b>43%</b> (70 of 161 incidents)	<b>48%</b> (78 of 161 incidents)	<b>8%</b> (13 of 161 incidents)

**Operational level implication:** Sailor violence cannot be solved independently of alcohol misuse and abuse. Therefore, prevention of alcohol misuse must have the same priority as prevention of violence. Nonetheless, sailor violence is a problem in its own right, and cannot become an issue subordinate to alcohol abuse.

### **3.4 Leadership communications about violence in the Navy matters**

Leadership ought to matter. But what should Navy leadership do to positively influence the incidents of violence that affect sailors? Our research uncovered no prior studies that related leadership, and more specifically leadership communications, to incidents of violence. Some articles did, however, provide advice that appears sound, including that discussions of violence should be cast in terms of the Sailor’s Creed and the Navy’s core values of Honor, Courage, and Commitment:

- Honor. It is dishonorable to commit violence against non-combatants.
- Courage: People look to sailors to have the courage to stand up for what’s right.
- Commitment: Sailors are professionals, committed to professional behavior.

Although we found no studies that directly linked leadership communications with reductions in levels of violence, we did uncover a 1987 study that is relevant.<sup>29</sup> That study focused exclusively on the Marines at Camp Pendleton and examined how management policies affected unauthorized absences. Among the measurable effects that

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<sup>29</sup> Ann Majchrzak, *Effects of Management Policies on Unauthorized Absence Behavior*, Journal of Applied Behavior Science, vol. 23, no. 4, pp 501-523, 1987.

were discovered were that *consistency and frequency* of the message communicated by leadership has, by itself, a powerful effect on reducing the rate of unauthorized absences (and, by proxy, rates of incidents of violence). Thus, the principal finding, extrapolated to incidents of violence, can be stated as:

**Operational level implication:** Communication of relevant policies influences a unit’s rate of incidents of violence. However, this reduction will be realized only when the communications are *consistent* among the leaders, and when the policies are *well understood* by the service members. This implies frequent discussion and clarification of the policies. Perceptions of fairness of the policies and the severity of punishments are less important than “staying on message.”

Following our background research, we conducted our own investigation of the *perception* of leader communication by sailors when the topic is sailor violence. The goal was to understand how sailors perceive this topic as it is currently being addressed in briefings or other means of communication. Simply put, we were interested in what leaders are saying, what sailors hear, and how those might be different. Our research also probed for insights of communication best practices, from the perspectives of both leaders and sailors.

The investigation, although limited, included qualitative interviews, semi-structured focus groups, and informal conversations with 24 participants coming from the Naval Postgraduate School (NPS), THIRD Fleet Headquarters, and aboard *USS TARAWA*.<sup>30</sup> Participant ranks ranged from E2 through O8, and length of service ranged from 1 to 33 years. All participants were assured of confidentiality and signed a release stipulating the confidentiality conditions.<sup>31</sup> Both the interviews and the focus group data were recorded, with permission by the participants, and transcribed for analysis purposes. The informal conversations were not recorded but field notes were taken. The data were then analyzed for themes that emerged relative to perceptions of communication about sailor violence, as well as the efficacy of communication behaviors and practices.

### **3.4.1 Venue, frequency, and circumstances surrounding communication**

Respondents said that they typically heard about violence, and particularly domestic violence, during General Military Training (GMT), Indoctrination (ID) to the command, or on pre-deployment or post-deployment briefings. There was consensus that communications outside these venues were often reactive to an incident rather than proactive, and that the frequency increased in reaction to incidents of violence.

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<sup>30</sup> ESG 1 and PHIBRON 1 staffs were embarked aboard *USS TARAWA* and our discussions included them as well.

<sup>31</sup> The confidentiality assurance and release was conditional, and participants were apprised that any disclosure of illegal activity would be reported to the appropriate military authority. However no illegal activities were disclosed during the course of the interviews, and the spirit of confidentiality is maintained throughout this report.



Several respondents shared their perspective that the focus should be on prevention of violence rather than primarily as a response to increased incidents. As one sailor put it, *“They tend to bring out the negatives first, the problems. I think you have to look at why people engage in domestic violence. If they dealt with that first, maybe they could focus more on prevention.”* Another respondent acknowledged the importance of reaction and response, but noted that *“I think the bigger thing is ‘How can I prevent it? How can I stop it?’”*

There was variance among the respondents as to how frequently the issue was addressed overall. For example, one respondent aboard *USS TARAWA* noted that the issue was addressed *“every time”* there was GMT, and another noted that, *“we hear about violence all the time.”* This was the first assignment for both of these respondents, and both had less than four years in the Navy.<sup>32</sup> However, among the respondents at the Naval Postgraduate School, a group of Navy and Marine officers that had experienced various commands, the feeling was that domestic violence specifically, and violence in general, was rarely addressed. One respondent said that he *“heard about it once in 1997,”* but that he had *“been on four deployments since then and never heard about it again.”* Another noted that *“the first time I ever heard about ‘domestic violence’ was at NPS ... I never heard it addressed as part of coming to a new command.”* Others at NPS noted that they had heard about it more on pre- and post-deployment briefings since 9/11, but overall the perception on the part of NPS officers was that violence was not a topic that was addressed very frequently in the Navy.

These findings regarding frequency raise several questions. It may be that the discrepancy reflects different command priorities. Some commands, such as *USS TARAWA*, may emphasize the issues of violence more than other commands. However, it may also be the case that messages about violence are more targeted toward enlisted personnel – specifically junior enlisted personnel – rather than officers. Given that all the NPS respondents were officers rather than enlisted, this latter explanation may have some validity. The limitations of the sample preclude a definitive conclusion regarding this discrepancy. Regardless, the findings do suggest that there is not uniformity in perceived frequency of the message, which may indicate that the topic of violence is not considered as critical as, for example, other issues more uniformly addressed such as drinking and driving.

Respondents also noted that the issue of violence, when addressed, was often discussed amidst many other topics in GMT or other briefings. Although they hear the spoken word, they take meaning from unspoken words as well, leading to an inference of whether this is a “real topic” or one that is merely getting lip service. One respondent offered the view that it is *“tough to know where [violence] falls on the hierarchy of importance.”*

Additionally, respondents reported that the venues in which the topic is addressed may impede sailors taking in the information: *“the topic [violence] is usually thrown in with*

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<sup>32</sup> It is tempting to note that in our database of violent incidents, *USS TARAWA* has far fewer reported incidents than other comparable ships (LHA/LHD). However, we continue to believe that the database is not sufficiently reliable to draw meaningful conclusions from this. Even so, our observations led us to conclude that the commanding officer of *USS TARAWA* was more proactive than the norm.

500 other things, and by then they're all spaced out from having two hours on other things." Another respondent noted that the demands onboard ship make the indoctrination brief only partially effective: "[Indoctrination] is tough because the environment around the ship makes it tough for the sailor to take in," referring to the multiple tasks sailors are accountable for such as standing watch, attending to job responsibilities, and dealing with other collateral duties.

The Fleet & Family Support Center (FFSC)<sup>33</sup> and the Family Advocacy Program (FAP) were consistently mentioned as good venues for addressing the issue. One respondent wondered whether it was effective to address the issue substantively onboard ship or in the work environment, calling the FFSC and FAP "a better environment . . . where you may focus more." However, there was also a common perspective that there can be a stigma associated with getting involved with these services. For example, one respondent noted that "once you get tied into this Family Advocacy thing, you're kinda labeled." One potential consequence of this stigma that is well documented in the literature<sup>34</sup> is that victims may be reluctant to seek help because, as one respondent noted, "they don't want to get the military spouse in trouble." Thus, while FAP is widely seen as a good program, it cannot substitute for command involvement.

**Operational level implication:** There is substantial room for improving command discussions about violence. The discussions must be genuine because sailors will attribute the priority to the topic that they *perceive* the command leadership holds. Increased frequency of discussions does not mean longer discussions, but would make the subject less prone to being lost among others.

### 3.4.2 Leaders: A broad term

Respondents discussed what was effective and ineffective about training in which sailors were given cautionary messages about violence. One key theme was that sailors look to *many* people for information about this and other difficult topics, not only the trainer(s). Numerous respondents echoed the view expressed by one: "I think generally it's the peers and the immediate supervisors who are the ones that recognize if something is going on." Additionally, there may be practical reasons why a peer would be the first one to notice or be made aware of a problem. One senior enlisted sailor noted that "there's a mindset out there to keep things at the lowest level. So, somebody will probably call a peer or friend if they're in some kind of crisis or trouble."

These perceptions raise a key point. Leadership can and should extend to every sailor who calls himself an "officer," including Petty Officers (E4 – E6). Gaining a shared agreement on this will help to overcome the belief by some, as expressed by one respondent: "People don't tend to other people who have problems because they don't want to deal with anyone else's problems. Everyone has problems; we all have our own issues." Involving all levels of leaders, including Petty Officers, helps ensure that the

<sup>33</sup> This was previously known as Fleet Family Services (FFS).

<sup>34</sup> Caliber Associates, *op cit.*, 1994.

leadership is present where the problems are. That would solve part of the problem; the other part of the problem is to ensure that all of these Petty Officers see themselves as having responsibilities for leadership. Otherwise, *“the people who are most apt to notice if something is odd or wrong with someone else is a peer, but they often won't do anything about it.”*

All leaders are not equal, however. Leaders at different levels have different roles to play. A flag officer noted that *“As a young ensign, I don't think I could quite see how I was responsible for my people's behavior on liberty. But now, many years later, I can see how.”* Meanwhile, a Senior Chief Petty Officer noted the importance of being there for his sailors during times of crisis or trouble: *“Sailors know that if something goes down that they should be able to call their senior chief. I think we are the bond between the white collar worker wardroom and the blue collar worker sailor.”*

Not only is it important for non-commissioned officers to exhibit leadership on this issue, it is also important for senior leadership to visibly support the communication of policies about violence. As one sailor put it, presentations of *“domestic violence messages need to have the Captain present so it is clear that he backed what the spokesperson was saying.”* This was not a lone respondent, nor one reflective of a particular paygrade. For example, a junior officer contended that domestic violence was actually more prevalent and had more impact on sailors' lives than DUIs: *“I would like see it [domestic violence] pushed up to a higher level of leadership. The damage created by family or domestic violence issues has had more of an effect on me as a leader, and on the people involved as well.”*

While we may agree, in principle, on the importance of leadership, the application can be complicated. For example, one junior officer said he was reluctant to get involved in another family: *“Because this issue [domestic violence] deals with someone's family, which is kind of a sacrosanct topic, we're afraid to butt in.”* Another junior officer noted that: *“I think it's something we want to avoid. It's a sticky situation, domestic violence isn't a right or wrong, you have to see, was there domestic violence? Just because a spouse says there was, doesn't mean it happened. Is that her venue for getting him in trouble and to wreck his career? I think it's something most officers try and refrain from [getting involved in].”*

Even when leaders – commissioned officers, non-commissioned officers, or Petty Officers – attempt to help, there may be additional challenges. *“So you try to approach it and let them know that the door is open, but then again, what can I really do?”* This respondent, a commissioned officer, explained that when she approached one of her sailors about the possibility of violence at home, *“she kind of said ‘Oh no, I'm fine.’ People want to deny when this kind of thing is happening, so your hands are tied.”*

**Operational level implication:** Leadership extends to all sailors who hold the title “officer,” from E4 to O10. The role of senior leadership is to ensure that all levels understand the responsibilities that they have. The responsibilities are not equally divided, but each leader has a role to play. In many cases, the junior leaders are better positioned than senior leaders to prevent violence.

### 3.4.3 Sincerity and credibility of leaders

Respondents stated repeatedly that it is important that leaders genuinely care about their people in order to engender the trust necessary to have an influence on potential victims and perpetrators of violence. Several enlisted sailors, for example, said that “good” communication was important and, when asked to describe a “good” communicator, they noted the importance of sincerity and directness. Along with this sincerity and directness, enlisted sailors also saw importance in leaders staying “*down to earth,*” being “*approachable.*” As a senior chief put it, “*I think the magic is that first they have to understand that you sincerely care about them.*”

The key factor underlying a sincere attitude was repeatedly expressed as knowing one’s people: “*you gotta know your people to be able to see the difference between a bad day and something really wrong,*” and another respondent asserted that leadership needed to “*actually get out there and know their general sailors, they need to get out there and start knowing everybody.*” Finally, good communicators were described as people whose actions backed up what they said, those who communicated with “*their actions more than their words. They didn’t just say something; they took action before they said it. They showed their words.*”

Respondents also cited the lack of credibility as one potential barrier to sailors being open to messages about domestic violence. In some cases, respondents bemoaned leaders who seemed to be there “*for signature purposes only,*” and didn’t take the time to know their people. Another respondent asserted that sometimes the problem could be a lack of sincerity when talking about the issue: “*If they [sailors] don’t think that you are sincere in your message, then they’re going to dial you out. If you’re just gonna punch that ticket and you’re gonna assemble them either in an auditorium, or you’re gonna have them in an office like this and you’re gonna preach to them, then you’re in the off mode. They’re waiting for you to have some silence so they can get up and leave.*”

**Operational level implication:** Sincerity and credibility matter in the eyes of sailors. They hear the words, but also look at the actions. Preventing violence must be an issue that leadership cares about, rather than an issue that leadership feels obligated to deal with.

### 3.4.4 Communication techniques for training

Many acknowledged the importance and necessity of one-way, formal communication about important issues such as violence. Within that venue, however, many respondents shared ideas on certain techniques that were more effective than others. One key theme expressed repeatedly was the importance of identifying with your audience through stories, actual experiences, and scenarios that they can actually relate to. “*A good briefing has people who share actual experiences, from people who actually went through something, and they share their stories. It makes you want to listen. After the story, you actually want to hear what they’re talking about. [They’ve said] something that actually grabs your heart.*”

In some cases respondents expressed that briefings lack impact because the topic doesn’t relate to the sailor, a perspective that supports the idea that messages need to relate as

much as possible to the audiences being addressed. Another sailor offered that in order to connect with the audience about domestic violence prevention, one “*shouldn’t say ‘it’s you,’ [rather,] you say that it’s your sister, or your girlfriend, or boyfriend, or little brother, or mother, then they get it,*” noting that there’s often the problem of invincibility and people not believing it could happen to them. As one chief put it, “*I think a lot of the sailors that are in today think they’re bullet-proof.*”

These techniques for good communication are not always followed. As one respondent noted, sometimes the briefings can seem like a waste of time: “*I’ve been in the environment where you sit there and get preached at, and somebody gets to check the log, and you get up and leave and say, ‘well, that was meaningful, thanks. Thanks for wasting my hour and a half.’*” Another respondent noted that often the response to briefings is “*OK, here we go again,*” emphasizing that the message is redundant.

**Operational level implication:** There is room for improvement in formal training on matters of violence involving sailors. Effective presentations on violence prevention and recovery should have a story to tell, presented in an environment where it is clear that senior leadership cares about the subject.

### 3.5 Other factors related to incidents of violence

There are factors besides those already discussed that could be related to incidents of violence. It is plausible that some of these factors are even dominant, such as:

- OPTEMPO, PERSTEMPO, and DEPTEMPO
- Time of year in absolute terms (e.g., December) or in relative terms (e.g., month prior to long-term deployment)
- Location of the homeport
- Navy policies with heavy reliance on personnel changes such as *Sea Swap* or *Optimal Manning Experiment*
- Stresses associated with the Global War on Terrorism

If there are relationships such as these, they should be embedded in recorded data of violent incidents. However, they may not (and probably will not) be obvious from a simple examination of the data. To understand why this is so, it is useful to illustrate the data from which we are trying to draw inferences.

We have three similar, but non-identical, spreadsheets from AIRPAC, SURFPAC, and SUBPAC. Each spreadsheet is based on individual unit SITREPs, and was recorded over a period of time (typically FY 2003 – FY 2004). Figure 4 illustrates a subsection of one of the spreadsheets – in this case, the full spreadsheet contains SURFPAC data and has 484 rows and 27 columns, with each row corresponding to a single incident, and the columns containing details of the incidents.

Command	Incident date	Alcohol	Nature of violence	Susp Rank	Susp Gender	Susp Ethn	Victim Rank	Victim Gender	Victim Ethn
GARY	Oct-2002	Unk/Yes	Sexual - child	E3	Male	Black	Civilian - family	Female	Black
GARY	Sep-2003	Yes/Yes	Object	Civilian - family	Female	Unknown	E4	Male	Unknown
GARY	Jan-2004	Yes/Yes	Object	Civilian - family	Female	Unknown	E6	Male	Black
GARY	Feb-2004	Unk/Yes	Hands or fists	E4	Male	Black	Civilian	Female	Black
GARY	Sep-2004	Unk/Unk	Hands or fists	E4	Male	Caucasian	Civilian	Male	Asian
GEORGE PHILIP	Aug-2001	Yes/Yes	Hands or fists	E6	Male	Black	E5	Female	Black
GEORGE PHILIP	Sep-2001	Unk/Unk	Unknown	E4	Male	Asian	Civilian - family	Female	Unknown
GEORGE PHILIP	Jan-2002	Unk/Unk	Sexual - child pornography	E1	Male	Unknown	Civilian	Unknown	Unknown
GERMANTOWN	Oct-1999	No/No	Weapon - knife	Civilian	Female	Caucasian	E5	Male	Black
GERMANTOWN	Jul-2001	Yes/No	Hands or fists	E5	Male	Caucasian	Civilian	Female	Asian
GERMANTOWN	Nov-2002	No/Unk	Hands or fists	Civilian	Male	Black	E3	Female	Black
GERMANTOWN	Apr-2003	Unk/Unk	Hands or fists	Unknown	Male	Caucasian	Civilian	Female	Unknown
HARPERS FERRY	Apr-2000	Unk/Yes	Weapon - knife	E5	Male	Black	Civilian	Female	Black
HARPERS FERRY	Jul-2000	No/No	Weapon - knife	E5	Female	Caucasian	E5	Male	Caucasian
HARPERS FERRY	Aug-2000	Unk/Unk	Weapon - knife	E5	Male	Black	Civilian	Female	Black
HARPERS FERRY	Jan-2001	No/Yes	Hands or fists	E5	Male	Black	E4	Female	Black
HARPERS FERRY	May-2002	No/No	Hands or fists	E3	Male	Black	E3	Female	Black
HARPERS FERRY	Nov-1999	Unk/Unk	Hands or fists	E6	Male	Unknown	Civilian	Female	Unknown
HIGGINS	Dec-1999	No/Yes	Hands or fists	E5	Male	Caucasian	Civilian	Female	Caucasian
HIGGINS	Jun-2002	Unk/Unk	Hands or fists	E5	Male	Caucasian	Civilian - family	Female	Caucasian
HIGGINS	Apr-2003	Unk/Unk	Sexual - child molestation	E4	Unknown	Unknown	Civilian	Unknown	Unknown
HOPPER	Jan-2000	Yes/Yes	Weapon - knife	E3	Male	Black	E4	Male	Black
HOPPER	Sep-2000	No/No	Hands or fists	Unknown	Male	Caucasian	E2	Female	Caucasian
HOWARD	Nov-2001	No/No	Hands or fists	E3	Male	Black	E3	Female	Black
HOWARD	Dec-2001	No/No	Hands or fists	Civilian - family	Female	Caucasian	E4	Male	Caucasian
HOWARD	Jan-2002	Unk/Unk	Weapon - knife	E5	Male	Caucasian	E5	Female	Caucasian
HOWARD	Apr-2003	No/No	Object	E4	Male	Black	Civilian	Female	Black
HOWARD	Oct-2003	Unk/Unk	Hands or fists	E3	Male	Black	E3	Female	Black
HOWARD	Jan-2004	No/Yes	Hands or fists	E4	Male	Hispanic	E3	Female	Hispanic
HOWARD	Feb-2004	No/No	Weapon - knife	Civilian - family	Male	Black	E2	Female	Black
HOWARD	Apr-2004	Unk/Yes	Hands or fists	E5	Male	Black	Civilian - family	Female	Unknown

Figure 4. Representative sample from SITREP spreadsheet

This sample is sufficient to illustrate the nature of the data, and to illuminate the difficulties in trying to discern whether tempo, or homeport, or time, or some other factor is significant in the data. The three full spreadsheets, although large, suffer the problem common to all databases related to incidents of violence – they are incomplete, have human error (noise), and have systemic errors (bias). Therefore, analytic approaches must recognize these limitations and work around them.

Classical statistical hypothesis testing is one analytic approach, but we were disinclined to try that because other studies that have used that approach have generally failed to find strong statistical significance in the data. This led us to look for a pattern recognition technique to discern the degree of correlation (loosely defined) between violence and these factors.

### 3.5.1 Pattern recognition approach

We chose an approach that could “recognize” if there were statistical differences between two subsets (populations) of violence data that would relate to some underlying conditions such as the tempo, or time, or place, or other circumstances that lay behind the incidents. The approach that we used is based upon a technique developed by Fukunaga and Mantock.<sup>35</sup> Among the desirable features are:

- Multiple dimensions are included. Thus, one application can encompass multiple factors such as time of incident, location of incident, ages/genders/races of perpetrators and victims, alcohol involvement, severity of violence, etc.

<sup>35</sup> K. Fukunaga and J.M. Mantock, *A non-parametric two-dimensional display for classification*, IEEE Transactions on Pattern Analysis and Machine Intelligence, PAMI 4.4, 1982, pp 427-436.

- The approach is non-parametric. This means that there are no underlying assumptions about the statistical distributions of the data.
- While encompassing multiple dimensions, the “patterns” are displayed in two dimensions, allowing humans to use their cognitive abilities to “see” the degree of differences between two populations.
- The two-dimensional patterns are readily transformed into estimated probabilities of misclassification – in essence the classical tradeoffs between “false negatives” and “false positives.”

For each application, the comparison is between two populations, generically labeled as “red population” and “blue population.” The appendix provides a tutorial that further explains the procedure and how to interpret the “operating curves” that form the tradeoffs between false negatives and false positives.<sup>36</sup>

Figure 5 is taken from the appendix and shows operating curves for three different pairs of red-blue populations, with:

- (a) vastly different statistics (heights of jockeys vs. basketball players)
- (b) significantly different statistics (heights of men vs. women); and
- (c) identical statistics (random numbers drawn from a common distribution).

These three examples allow us to form intuition about how to look at an operating curve and interpret the amount of statistical differences between two populations, based on the relationship between the empirical curve and the 45-degree reference line. We also placed Venn diagram illustrations, to indicate the general (not precise) degree of overlap in the two populations, ranging from no overlap (Figure 5-a) to complete overlap (Figure 5-c).

In the following sections that apply the pattern-recognition technique to the violence data, the operating curves generally look either like Figure 5-b (measurable but not vast differences) or Figure 5-c (no statistical differences).

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<sup>36</sup> As a technical matter, the pattern recognition method is based upon a “K<sup>th</sup> nearest neighbor” approach. We consistently display the results for  $K = 3$ , but verified that these results were consistent with other choices of  $K$ .

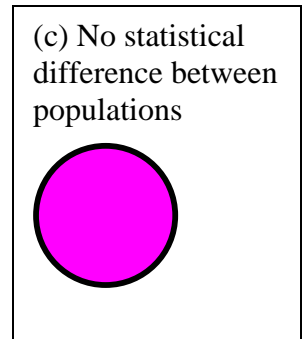
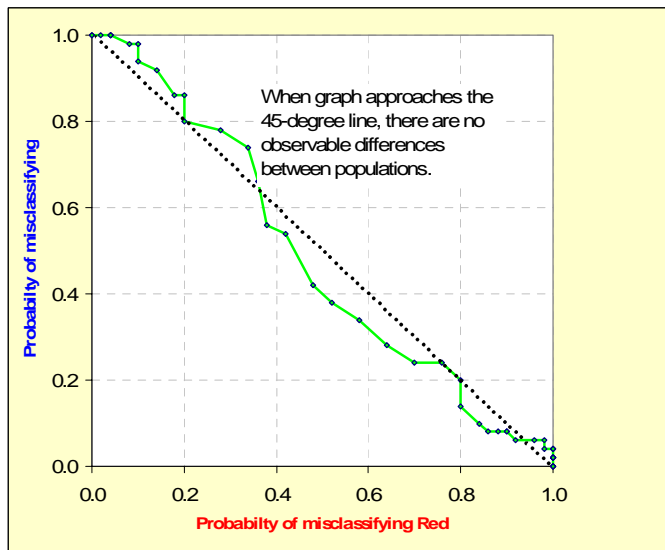
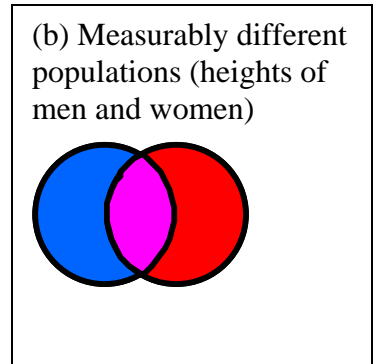
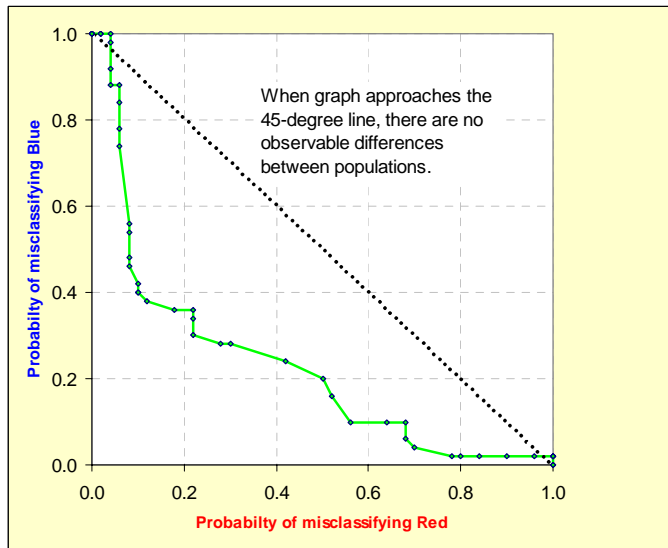
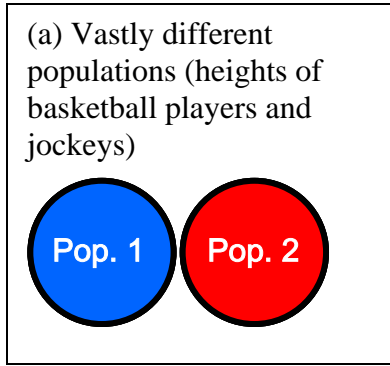
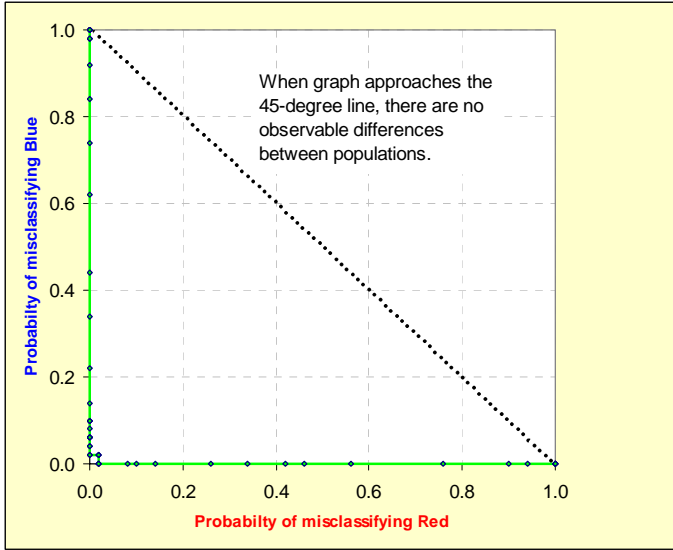


Figure 5. Three operating curves, for three different population pairs



### 3.5.2 Is tempo related to incidents of violence?

There might be a relationship between violence involving sailors and the personal tempos, PERSTEMPO or DEPTEMPO that they undergo. High tempos are generally stressful, and changes in stress levels could trigger incidents of violence. However, because our data on violence is non-personal, we cannot associate an incident with the tempo that the person was experiencing. We must look to OPTEMPO instead, because we only know the command to which the individual was attached and it is possible to find tempo data for a given ship. Unfortunately, there is no obvious way to link our violence data with unit OPTEMPO. For example, what should be measured: the tempo for the last month, or the tempo for the last six months, or the projected tempo for the next three months? Each of those will generally be different.

Faced with these difficulties, we isolated USS ABRAHAM LINCOLN (red population) as a unit with high OPTEMPO, and compared it with the other west coast aircraft carriers (blue population) to apply our pattern recognition technique. We did this because *LINCOLN* sustained a significantly higher tempo than other carriers over the years FY 2003-2004 for which we have our best data on incidents of violence. As Figure 6 illustrates, *ABRAHAM LINCOLN* (ABE) had a deployment of 9½ months beginning in July 2002. This deployment was significantly longer than the norm of six months, and significantly longer than other west coast carriers in that time period. We would like to see if this difference in tempo is manifested in the characteristics of violence.

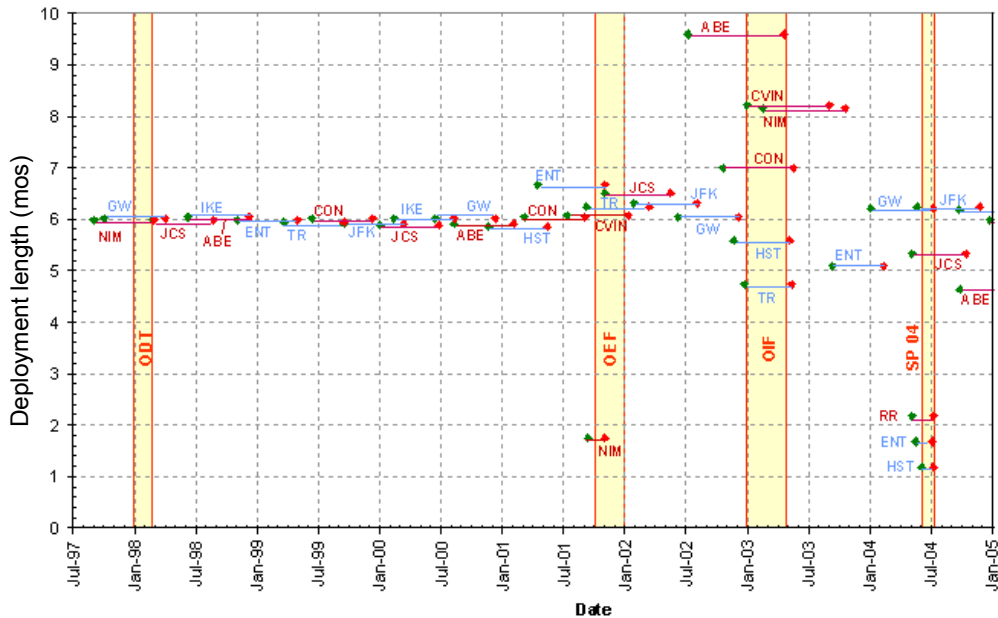


Figure 6. Historical deployment lengths for aircraft carriers

The most natural metric, of course, would be the total numbers of violent incidents, but our lack of confidence in the completeness of reporting leads us to away from that one.<sup>37</sup> Thus we applied the pattern recognition technique to these two populations, using data from AIRPAC for FY 2003-2004. For pattern recognition, we included 24 attributes for each recorded incident of violence, although in many cases, the attribute recorded for many of these is “unknown.”<sup>38</sup>

The result, shown in Figure 7, suggests that there are measurable, but not overwhelming, differences between the two populations. In other words, if we were given the data about the violence and made an educated guess of whether the source was *LINCOLN* or another aircraft carrier, we would be right more often than we would be wrong.

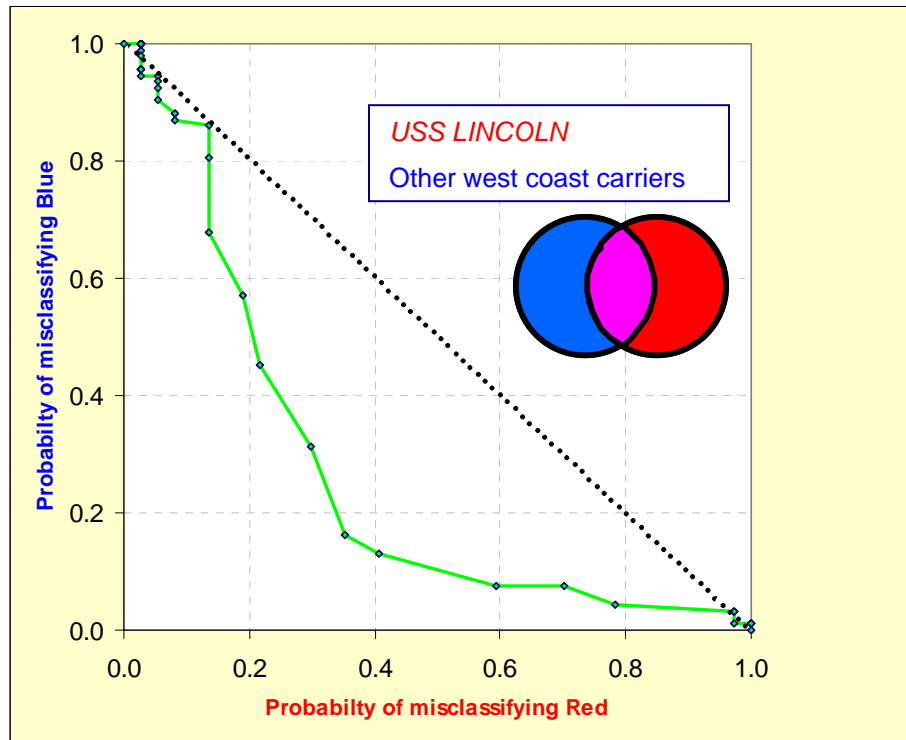


Figure 7. *LINCOLN* versus other west coast carriers

As tempting as it may be to look at this graph and conclude that high OPTEMPO leads to higher incidents of violence, that inference would be overstepping the limits of the technique. In the first place, although the graph shows that there are measurable

<sup>37</sup> In our database of FY 2003-2004 incidents, we have 37 incidents attributed to *LINCOLN*, in contrast to 7 for *CONSTELLATION* (which decommissioned in that time period), 16 for *VINSON*, 19 for *STENNIS*, 21 for *NIMITZ*, and 30 for *REAGAN* (which commissioned in that time period). Although not CONUS-based, *KITTY HAWK* had 56 reported incidents in the same time period.

<sup>38</sup> The 24 attributes were: incident date, on/off base, whether sexual, whether assault, whether domestic violence, alcohol involvement, weapon used, suspect gender, suspect race (4 categories), suspect military or civilian, suspect age, suspect paygrade (2 categories, officer & enlisted), victim gender, victim race (4 categories), victim military or civilian, and victim paygrade (2 categories).

differences between the two populations, it is only speculation that they are attributed to OPTEMPO. Perhaps more fundamentally however, is that although there are observable differences between the two populations, that doesn't necessarily mean that *LINCOLN* had "worse" incidents than the other. It just means that the characteristics of the *LINCOLN* incidents of violence are, in the aggregate, observably different than the others.

The next step is to take a closer look at the differences – in essence, digging into the data to find out why the differences were found. With the magnitude of data, that is a large effort, which is why we sought a pattern-recognition technique to aid us in the first place. However, pattern recognition imputes a degree of confidence in the accuracy of the database that may not be warranted. Nonetheless, relying on the pattern-recognition technique to alert us that there are observable differences, we then discover that, among other things,<sup>39</sup> *LINCOLN* reported relatively more suicide attempts (but not completed suicides) than other carriers and this is the dominant reason why the two populations tend to statistically diverge.

At the risk of being redundant, we stress that a *conclusion* that *LINCOLN* experienced an abnormally large number of suicide attempts would make unfounded assumptions about the accuracy of the database. However, even if we are not certain that there were more actual suicide attempts on *LINCOLN*, it would have been both prudent and appropriate for *LINCOLN* to have accentuated anti-suicide messages and counseling.

**Operational level implication:** Units undergoing high OPTEMPO should take additional anti-violence precautions.

### 3.5.3 Do interdeployment phases affect incidents of violence?

There are different phases that ships undergo when they are not deployed and there may be observable differences in the incidents of violence involving sailors as the phases change. This is an issue that could be addressed for any ship in the Navy. Specifically, by using *WebSked*,<sup>40</sup> the detailed historical schedule for each ship in the Navy can be extracted. However, this is a slow and tedious process, which led us to limit our examination to aircraft carriers only so that the complexity of the task could be reduced to a manageable level.

*WebSked* delineates many different levels of activity, even for ships undergoing local operations.<sup>41</sup> For purposes here, we simply delineate those phases as either maintenance (red population), by which we mean long-term (e.g., shipyard or drydock) maintenance,

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<sup>39</sup> As discussed in the Appendix, there are scatter-plots associated with each application of the pattern recognition technique. Each point of a scatter-plot equates with one violent incident, and thus outliers in the scatter-plots indicate where to look for causal relationships.

<sup>40</sup> *WebSked* is a SIPRNET-based tool that tracks past and future schedules of all ships in the Navy.

<sup>41</sup> Categories for local operations include enroute, carrier qualifications, vertical replenishment operations, underway replenishment operations, multi-group sail, fleet exercise, and others.

or pier-local (blue population), in which we include local exercises and operations, as well as short-duration pierside maintenance and upkeep.

As we did for the previous analysis, we examined 24 metrics for the population of west coast aircraft carriers.<sup>42</sup> The result, shown in Figure 8, shows some marginal differences between the two populations.

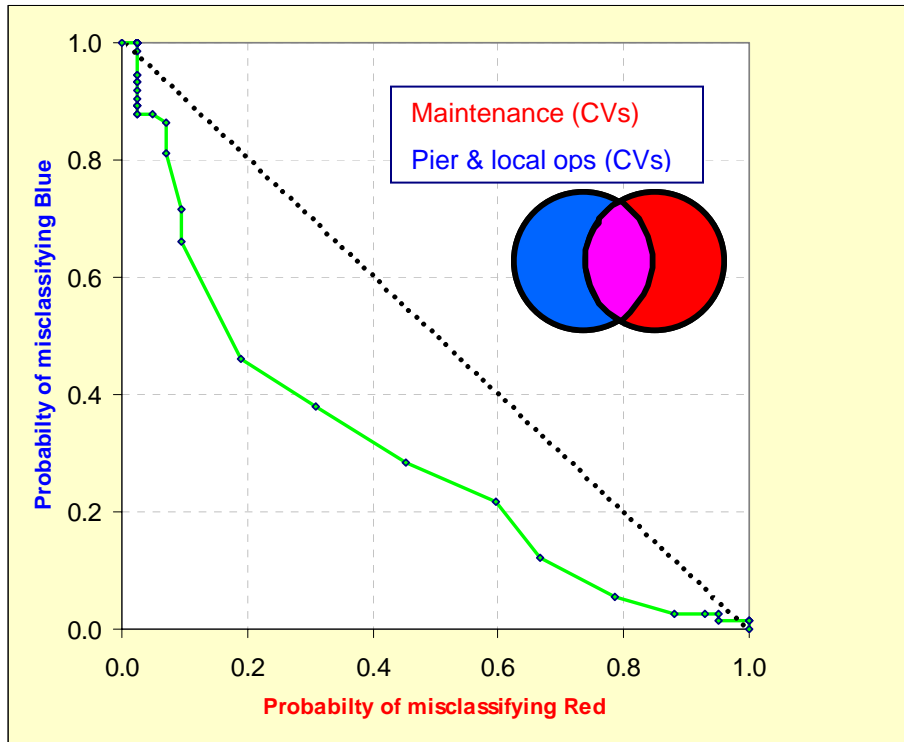


Figure 8. Maintenance versus non-maintenance periods

A theme that runs throughout these pattern recognition evaluations is that whenever there are observable differences between the two populations, it is not obvious which population is “worse” and which one is “better.” For insight on that issue, we must dig deeper into the specifics of the data. In this case, when we isolated some of the most outlying data points, we could find no “common denominator” that caused them to be unique. Indeed, the most dominant cause appeared to be either that much data about the incidents were unknown, or that much data about the incidents were known. However, because there are observable statistical differences between the two populations, we are led to recommend a note of prudence.

**Operational level implication:** Violence-prevention messages should be disseminated prior to each major change in phase. These messages need not be prolonged, but merely focused on “changes in personal lives” that are impending.

<sup>42</sup> *CONSTELLATION, NIMITZ, VINSON, LINCOLN, STENNIS, and REAGAN.*

### 3.5.4 Does the change of deployment status affect incidents of violence?

The previous comparison was between two phases within a non-deployed cycle. We could have posed a similar question about differences between deployed and non-deployed phases. However, the nature of our data would clearly find differences there because certain types of violence (e.g., domestic violence) simply do not happen except under unusual circumstances when ships are deployed. Furthermore, other incidents of violence are unique to liberty visits and don't allow a direct comparison to non-deployed periods. Thus, it is immediately obvious that there are differences in the characteristics of violence between deployed and non-deployed periods.

### 3.5.5 Does the time of year affect incidents of violence?

In addition to considering how time *relative* to the deployment cycle for a unit affects incidents of violence, we can also examine how *absolute* time affects them. For example, it is “common wisdom” that the December holiday season is stressful for many people, and thus it is plausible that this would translate into different characteristics of violent acts within the Navy community.

We applied the pattern recognition technique on violence data from SURFPAC, isolating incidents that occurred in November-December-January (red population) from those that occurred in other months of the year (blue population). The resulting operating curve is illustrated in Figure 9. This curve shows relatively few distinctive differences between the two populations. This is, of course, contrary to conventional wisdom that says that holiday stresses lead to higher levels of violence

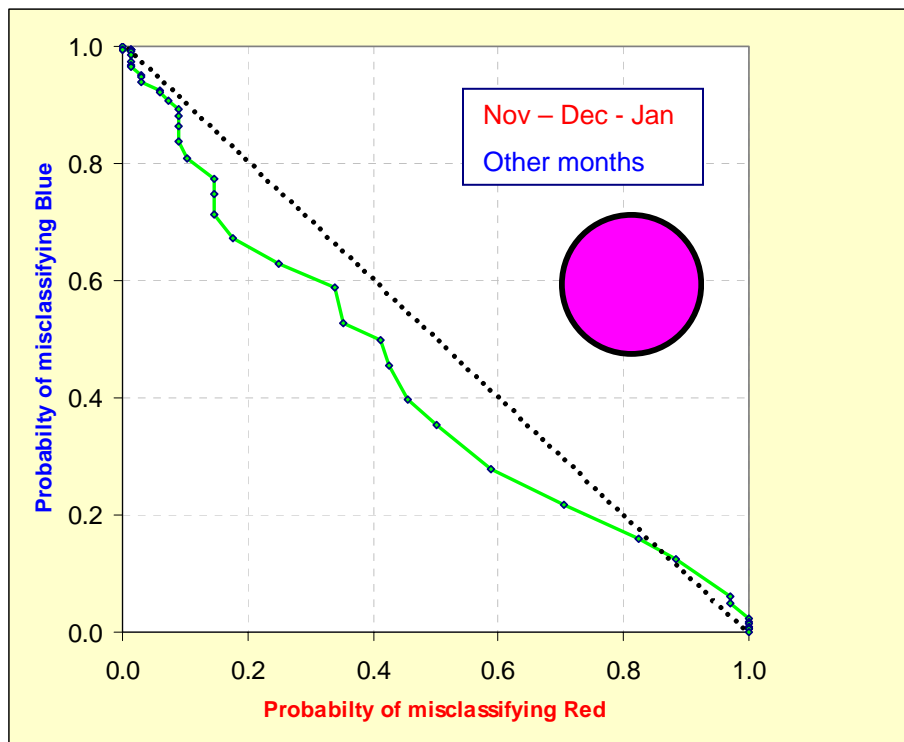


Figure 9. “Holiday months” versus the rest of year

We offer two observations about this apparent contradiction. First, as discussed earlier, the pattern recognition technique looks for differences in *characteristics* of violence, but not for differences in *numbers* of incidents. Thus, one could speculate that there is an increase in the rate of violent incidents during the holiday seasons that is not captured by the statistical technique. However, this does not appear to be true for our data, as there were an average of 23 incidents per month during the holiday season, and an average of 25 incidents per month during the non-holiday season.

A more compelling explanation for the apparent contradiction comes from the premise that the existing violence-prevention measures that are taken during the holiday season are effective, and that is why there are few observable differences between the two data populations. Thus, our recommendation to the operational commander is to stay the course.

<b>Operational level implication:</b> Continue with current holiday-related policies of discussing violence prevention.
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### 3.5.6 Does the homeport affect the incidents of violence?

We now shift from discussing how time (relative and absolute) affects incidents of violence to discuss how the place affects them. Specifically, we seek to discover whether there are any observable differences between incidences that happen in one locale or another. For this investigation, we used two databases – separately, for there are differences between them that prevent merging them.

For the first comparison, we took the SURFPAC database and isolated the incidents that involved ships based in San Diego (red population) and those based in either Bremerton or Pearl Harbor (blue population). Figure 10 provides the resulting operating curve. Hovering near the 45-degree line, there are no statistically-measurable differences between the characteristics of violent incidents based upon this choice of populations.

We next took the AIRPAC database, and isolated the incidents that involved aircraft carriers based in San Diego (red population) and those based in Bremerton/Everett (blue population). This is the same conceptual comparison that was made for the SURFPAC ships. However, Figure 11, the operating curve for the aircraft carriers, looks noticeably different from its SURFPAC counterpart.

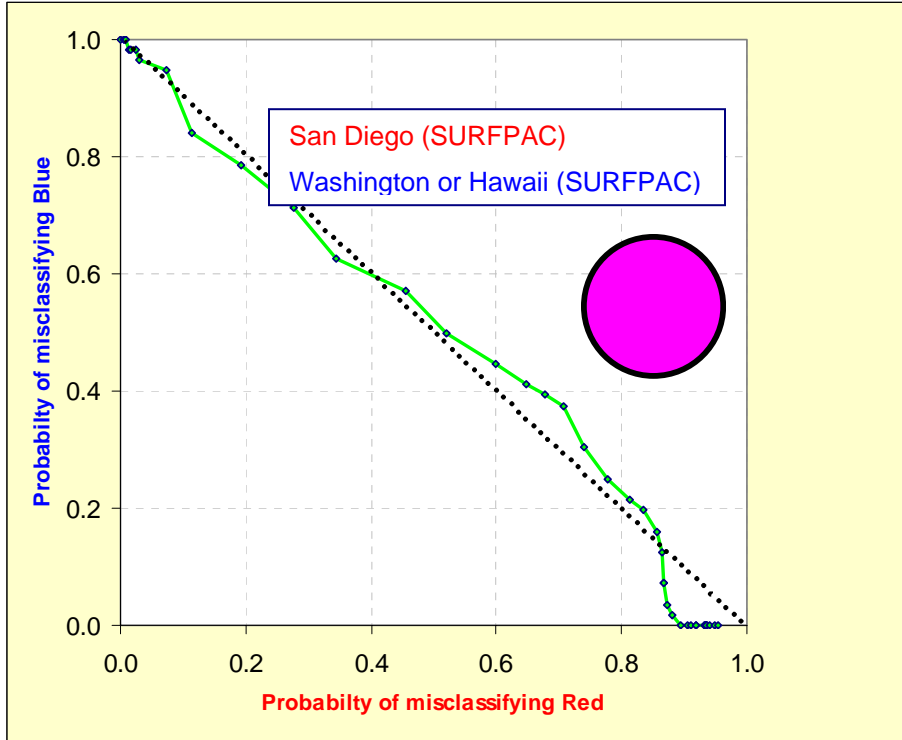


Figure 10. SURFPAC homeport of San Diego versus others

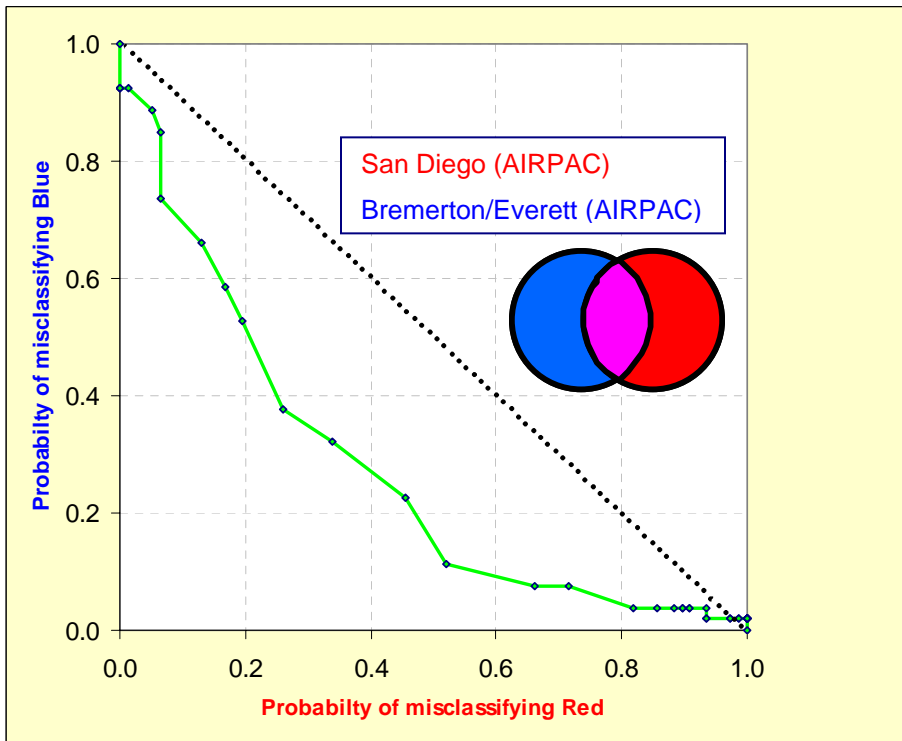


Figure 11. AIRPAC homeport of San Diego versus others

The obvious question that arises from these different statistical conclusions is whether the differences are real, or whether they reflect problems with the databases. It is certainly possible that the differences between the two curves could be from some fundamental (but unknown) differences between the factors related to violence as they apply to aircraft carriers and other combatants. However, we do not believe that this is the real explanation. Instead, we believe that this points to unintended bias in the databases. Our line of reasoning goes as follows.

The SURFPAC comparison is based on a relatively large number of reporting units: 53 ships based in San Diego and 16 ships based elsewhere. In contrast, the AIRPAC comparison is based on a relatively small number of reporting units: 4 carriers based in San Diego and 2 carriers based elsewhere.<sup>43</sup>

The problem is not with small number of reported *incidents*. Because there are far more sailors on aircraft carriers than other ships, each aircraft carrier has a relatively large number of reported incidents. In our case, there were 291 incidents from SURFPAC ships and 130 incidents from AIRPAC carriers. Rather, the problem may come from the small number of reporting AIRPAC units.

Regardless of whether it is the actual cause for the discrepancy between Figures 10 and 11, there can be observable pattern differences between two populations if the first population reports incidents with philosophy # 1 (e.g., report only those incidents that they are legally bound to report) and the second population reports incidents with philosophy # 2 (e.g., report all incidents, including the relatively minor ones). Indeed, the pattern recognition technique is very adept at recognizing these kinds of differences.

This leads us to suspect that inconsistent unit-to-unit reporting from the aircraft carriers introduces statistical bias. It is probable that similar biases are present in the SURFPAC data, but with far more ships involved in that data, these biases tend to look more like “statistical noise,” while the few ships involved in the AIRPAC data retains the “statistical bias” characteristics. In other words, we do not feel that the evidence is compelling enough to suspect actual differences based upon homeports.

**Operational level implication (tentative):** Violence-prevention measures should be applied uniformly to all geographical locations.

**Operational level implication:** Consistency of reporting across all commands, and communities, is required to determine actual trends in violence data. This consistency requires a common set of tools, a common set of definitions, and a common approach to recording data.

### 3.5.7 Do certain Naval policies affect incidents of violence?

The Navy has explored several policies that fundamentally alter traditional assignments to ships. One of these policies is *Sea Swap*, where entire crews exchange ships, with one

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<sup>43</sup> These numbers correspond to reported incidents of violence, and not the actual numbers of ships assigned to the homeports at any given time. In the case of aircraft carriers, the four based in San Diego are *CONSTELLATION*, *NIMITZ*, *STENNIS*, and *REAGAN*.



ship based in CONUS and the other deployed overseas. The full sociological impacts of a policy such as this are unknown, so it makes sense to see if there are unique patterns of violence associated with these ships.

In the FY 2002 – FY 2004 timeframe, seven ships participated in an experimental application of this policy:

- *USS HIGGINS* (DDG 76)
- *USS BENFOLD* (DDG 65)
- *USS JOHN PAUL JONES* (DDG 53)
- *USS FLETCHER* (DD 992)
- *USS KINKADE* (DD 965)
- *USS OLDENDORF* (DD 972)
- *USS ELLIOT* (DD 967)

For our analyses, we compared these seven *Sea Swap* combatants (red population) with all other CRUDES ships (FFG, DD, DDG, CG) (blue population). As Figure 12 shows, we found no pattern differences between these two populations. Although there are major issues involved in *Sea Swap*, the evidence to date suggests that a unique violence pattern is not one of them.

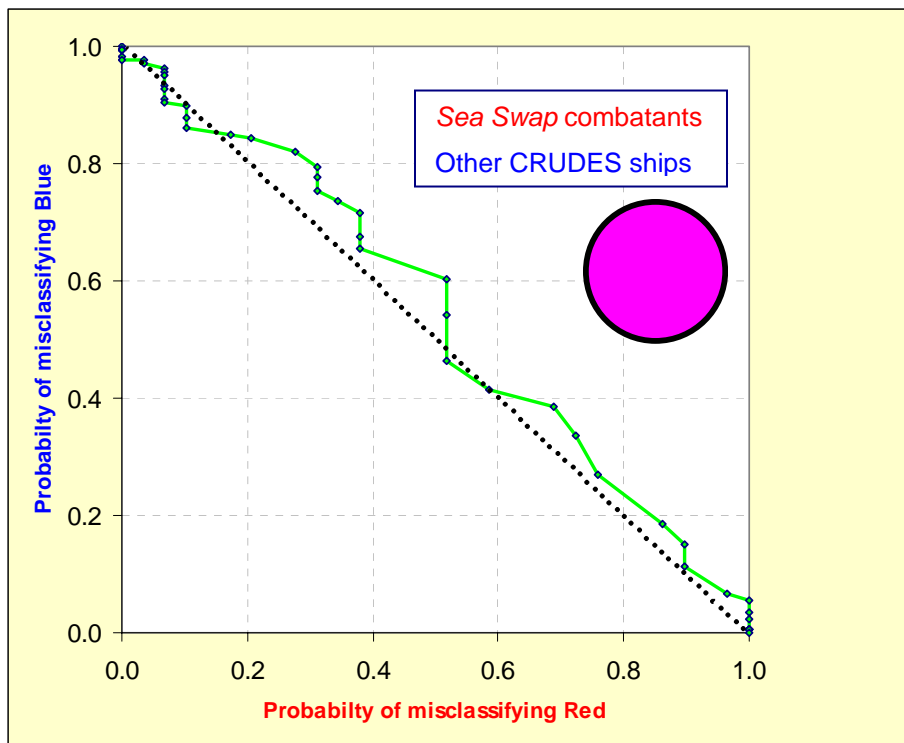


Figure 12. *Sea Swap* combatants versus other CRUDES

Another Navy policy that alters the sociological environment for sailors is the Optimal Manning Experiment (OME) that substantially reduces the numbers of sailors assigned to a ship. This reduction alters the work assignments of the remaining sailors, and transfers some functions ashore. On the west coast, three ships are involved in OME:

- *USS NIMITZ*, CVN 68 (AIRPAC)
- *USS BOXER*, LHD 4 (SURFPAC)
- *USS MOBILE BAY*, CG 53 (SURFPAC)

We focused our attention on *USS BOXER* (red population), and compared it with the other big-deck amphibious ships (LHA, LHD) (blue population). Figure 13 shows the resulting operating curve.

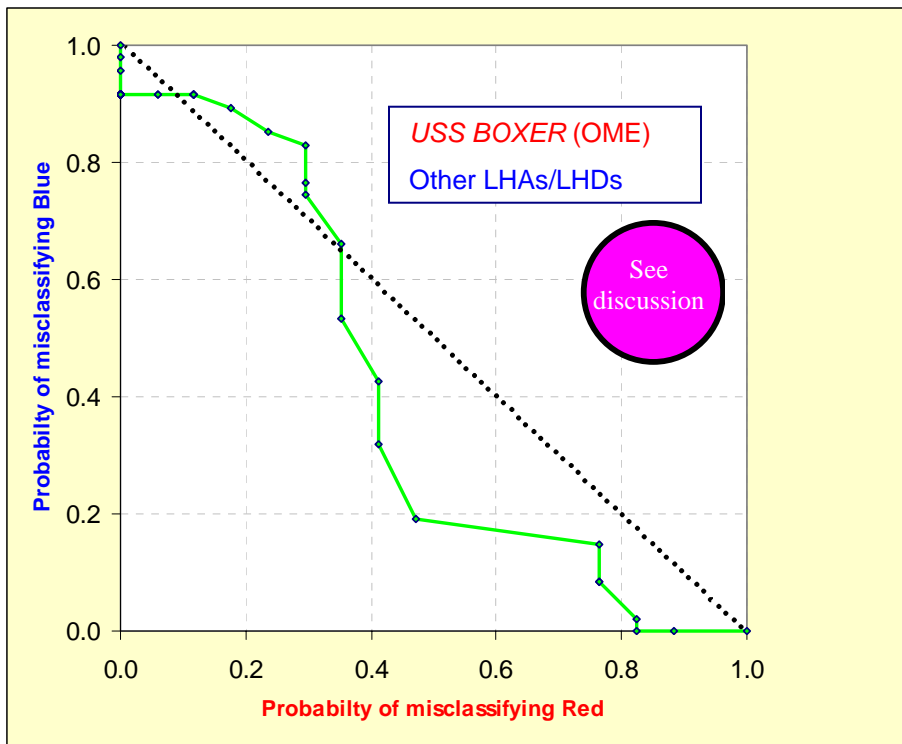


Figure 13. *BOXER* (OME) versus other LHAs/LHDs

The deviation from the 45-degree line is interesting, but upon further analysis, we do not attribute much significance to it. Instead, we believe that “small numbers” causes it – there were only 17 reported incidents from *BOXER* over the time period analyzed.<sup>44</sup>

<sup>44</sup> The pattern recognition method uses a  $K^{\text{th}}$  nearest neighbor approach. Throughout our analyses we display results for  $K = 3$ , but they are generally consistent with other values of  $K$ . This case represents an exception, because the results varied considerably for other values of  $K$ .

**Operational level implication:** New policies such as *Sea Swap* and OME have many far-reaching impacts, but they do not appear to alter the characteristics of incidents of violence. However, violence trends for these units should continue to be monitored.

### 3.5.8 Are post-9/11 incidents of violence different than pre-9/11?

For our last application of the pattern recognition technique, we looked for changes in the patterns of violence that may have emerged after 11 September 2001. Our data from AIRPAC and SUBPAC include reports only from FY 2003 – 2004, and thus could not help with this issue. Fortunately, the data from SURFPAC includes reports from FY 2000 – 2004, so it was selected for the analysis.

We took the incidents that occurred before 9/11 (red population) and compared them with the incidents of violence that occurred after 9/11 (blue population). The hypothesis was that the overall stresses that all Americans experience might alter the nature of violent acts. However, as Figure 14 shows, we see almost no effect in the violence data.

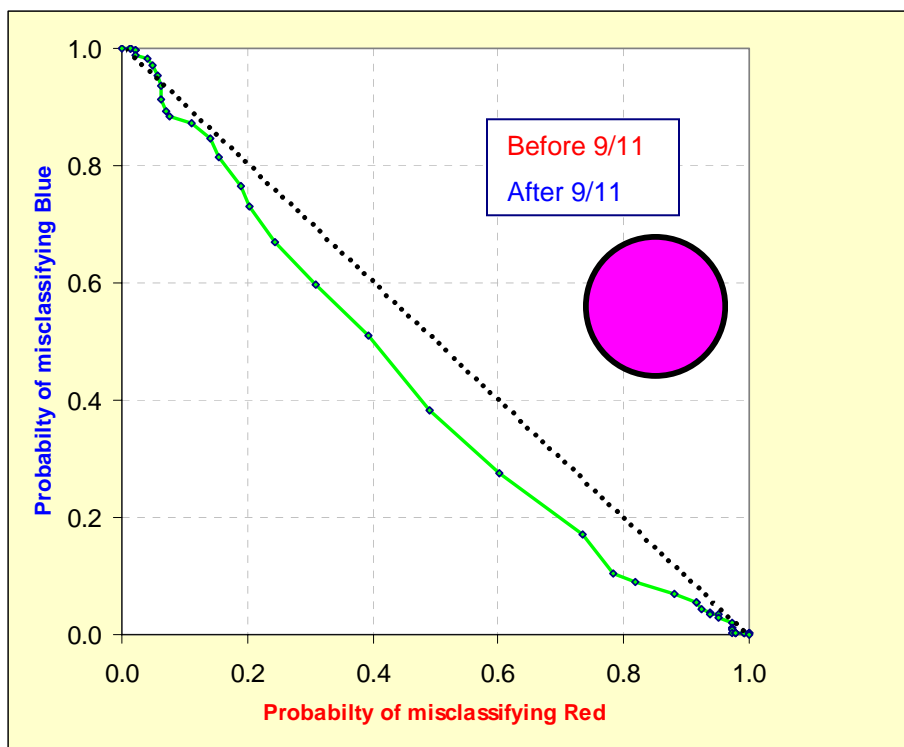


Figure 14. Pre 9/11 versus post 9/11

**Operational level implication:** Global stresses do not alter the characteristics of incidents of violence involving sailors.

### **3.5.9 Other possibilities not analyzed**

Our analysis, while comprehensive, could obviously be extended. It is easy to think of other factors that might have a causal relationship with incidents of violence. Among the possibilities are:

- Differences between the months preceding an overseas deployment and the months following one
- Differences between the early portion of a deployment period and the late portion of a deployment period
- Differences between periods where the commanding officer is relatively new and periods where the commanding officer is well established
- Differences between big-deck amphibious ships and aircraft carriers

An investigation of some of these questions cannot use the pattern-recognition approach described here, or at least not with the current databases. For example, because data on big-deck amphibious ships comes from SURFPAC and data on aircraft carriers come from AIRPAC, the differences between the two databases significantly complicate a comparison such as the third one suggested.

However, in general, many additional effects could be explored with the existing databases and the pattern recognition technique. Nonetheless, the major potential factors have been considered in our analysis, and we are satisfied that it is adequate for present purposes.

## 4.0 Future efforts

Reducing the incidents of violence involving sailors is a challenge worthy of all Navy leadership. Our analysis has been comprehensive, and cast in terms of implications of direct relevance to operational level commanders. Yet even if all of our recommendations are implemented, it is clear that enormous challenges will remain.

Our findings suggest that leadership communication does matter in preventing incidents of violence. However, the scope the study limits the degree to which we can draw general conclusions. Future research should broaden the scope of participants, across various commands and locales, to provide a broader basis from which to derive consistent themes of sailor perception. Additionally, our research was based on a convenience sample drawn from personnel at the Naval Postgraduate School, Commander THIRD Fleet, and aboard the *USS TARAWA*. This sample provided a good initial view of perceptions, but did not account for differences between commands or ranks (e.g., enlisted vs. officer, junior enlisted vs. senior enlisted, junior officers vs. flag officers, and the like). Future research should target specific populations to gain greater clarity on perceptions of different groups. Finally, any examination of communication effectiveness in preventing violent incidents should address actual perpetrators of violence. That is, research should explore the degree to which the perception of communication by leaders may or may not have impacted the sailor's propensity toward engaging in a violent act.

In addition to addressing issues related to participants, future research should also focus on exploring the perceptions surrounding specific messages and message delivery techniques. Such research would ideally examine various and actual messages regarding violence and the response to the specific messages by those targeted. This focus should attend to messages in both traditional venues (GMT, Indoc) and in smaller venues, such as department meetings, counseling sessions, and other informal communication situations.

The difficulties with tracking, measuring, and deriving statistical inferences about the incidents of violence have also been evident in our analysis. It has been clear that the statistical analyses provided statements about the underlying databases, which we *assumed* reflected reality. That assumption will be present in any such analysis, and therefore it is imperative that we pay proper attention to the underlying databases. Any database of these incidents can have three general types of errors, but these three are not equally important for analysis:

- Unintended bias = major issue. Biases are caused by systemic differences in reporting. For example, one command may report only those incidents that they are legally bound to report while another command may report all incidents, including the relatively minor ones. These differences can become significant in a statistical analysis of the data.
- Human error = minor issue. Whenever humans are involved, there will be errors. However through adequate training and supervision, these errors should appear as nothing more than statistical noise, and should not skew statistical analyses of the data.

- Incomplete data = non-issue (because it is an unattainable goal). The databases are destined to be incomplete, because many incidents will simply go unreported. While this is deeply unsatisfying, statistical methodologies must recognize this reality and work with this fundamental constraint.

A focus on the most-important issue, removing bias, demands that there be consistency of reporting across all commands, and communities. This, in turn, suggests a common set of tools, a common set of definitions, and a common approach. There is some good news here, because an approach being developed by Fleet Forces Command offers significant hope toward this goal.

However, realizing that goal will be more difficult than may be generally appreciated. Figures 15, 16, and 17 illustrate the Fleet Forces Command tool, called the Incident Data Collection & Reporting (IDC&R) tool, which is currently undergoing Beta testing. Through a series of menus, all relevant information can be entered for each incident, including data about the suspect, data about the victim, and data about the investigation of the incident.



Figure 15. IDC&R main page

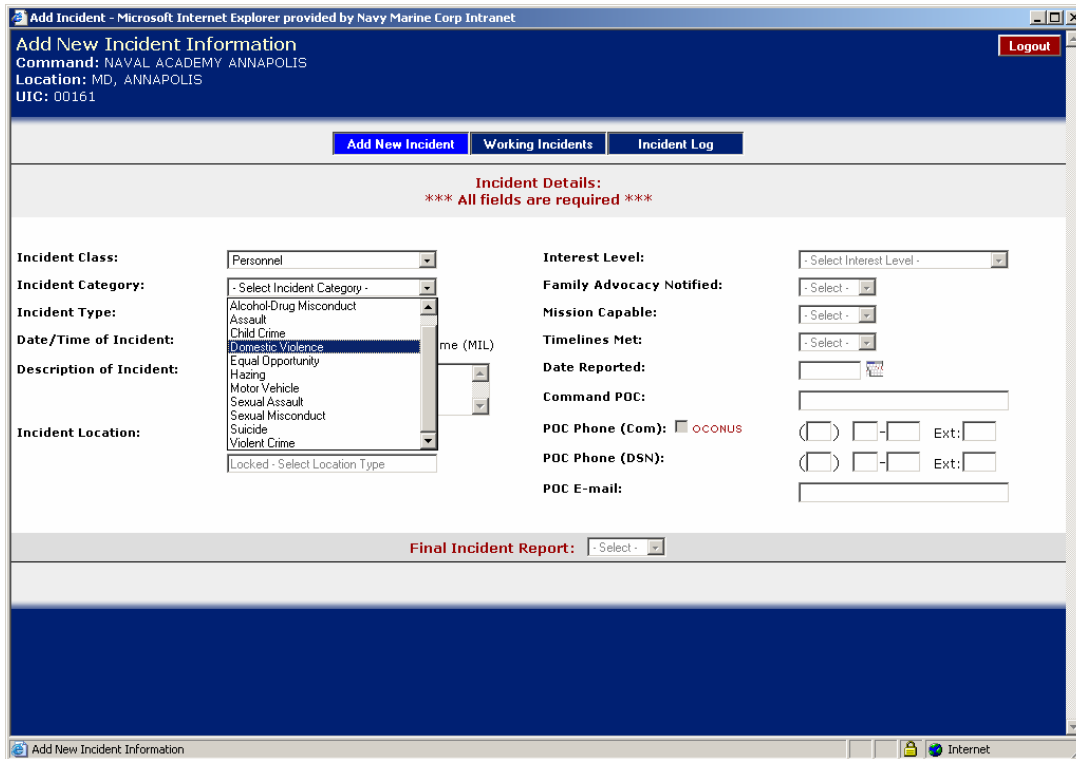


Figure 16. Drop-down menu selection in IDC&R tool

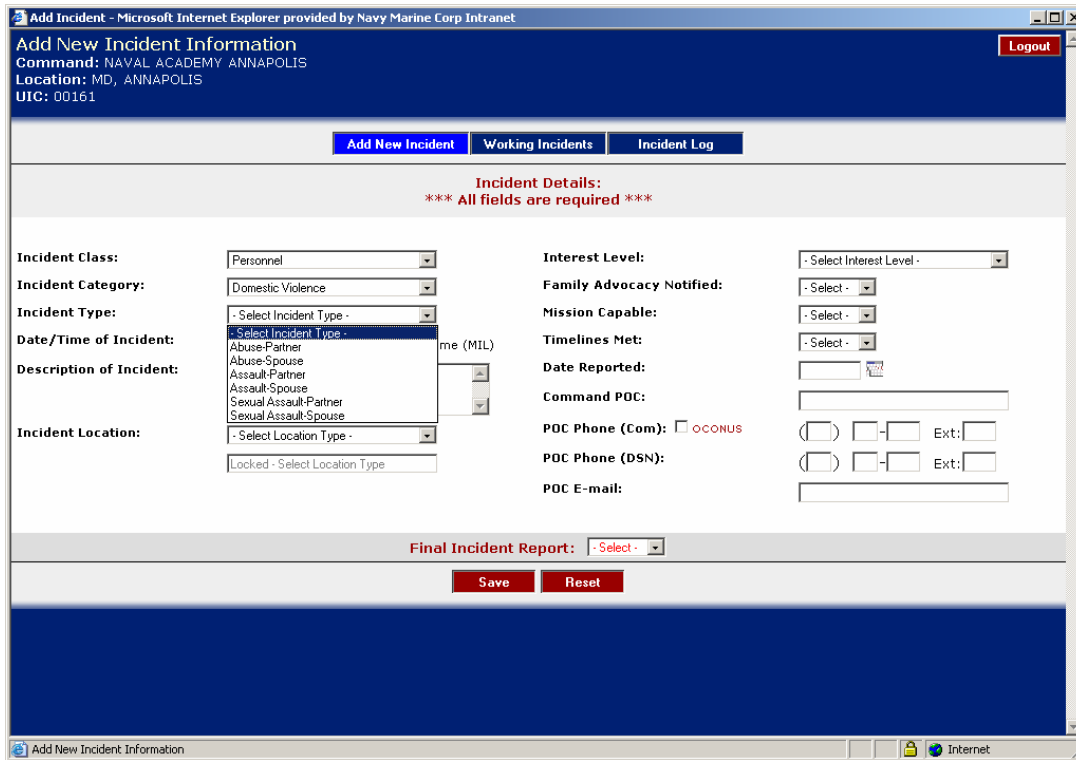


Figure 17. Drop-down sub-menu in IDC&R tool

There is a clear appeal of this relatively user-friendly tool. However, the tool is not without problems that will affect subsequent statistical analysis. Some of the problems are easily fixed, and should be corrected during the Beta testing of the tool. Examples of these fixable problems are:

- There are multiple bins for certain incidents. For example, Figures 16 and 17 show that sexual assault of a spouse might be entered via the domestic violence bin, or might be entered via the sexual assault bin. It is inevitable that similar incidents will be recorded differently, and that will cause statistical bias for analysis.
- The tool will not allow certain data fields to be left blank, even if answer is unknown. This will force users to knowingly input fictitious data, simply to be able to save the known data.
- In some cases, there are incomplete or inadequate sets of choices (e.g., for weapon). This may lead to the category of “other” or “none of the above” as the leading attribute.
- “Unknown” age is an acceptable input, but is translated into zero, which could skew certain aggregations (e.g., averaging) of the data.

However, in addition to these easily-fixed problems, there are some deeper conceptual-level problems that will compromise any statistical analysis of the resulting data. Examples of these types of problems include:

- The tool adopts a “binning” approach, as opposed to one where all applicable attributes are recorded. This leads to difficulties for some incidents, such as domestic violence where the victims include both a spouse and a child (i.e., multiple bins). Or, a possible suicide that was related to a drug overdose might be entered in the suicide bin, or in the drug bin.
- Elimination of data bias requires consistency of data input across multiple commands. Yet, the concept of the IDC&R tool is that each command self-reports but with no formal training planned. Even if there were a training program, the cost and complexity of it would be very large. Nonetheless, without training, it is unlikely that there will be a uniformity of employment of the tool, and that is the chief contributor to data bias.

This highlights a larger problem, and one that must be addressed for the desired breakthrough in monitoring and understanding the root causes of violence involving sailors. A better statistical tool than the pattern recognition tool used here could obviously be developed. However, without better underlying data, there is little to be gained doing that. Meanwhile, the IDC&R development is striving to generate better data. Yet, the preceding discussion illustrates that the data will not be easily exploited for statistical analysis. The solution to this larger problem seems clear: developers of the database and developers of statistical methodologies must work together. The tasks cannot be easily separated.



**Operational level implication:** Co-develop the ICD&R tool with an improved statistical analysis tool. They cannot be effectively developed independently of each other. Use the inherent limitations of each tool to guide the conceptual underpinnings of the other tool.

As a concluding note, we believe that this research has made significant progress in this difficult and important topic, but it is sobering to see how much more remains to be done. This overall topic is likely to be one of those enduring problems that never get solved completely.

## Appendix. Pattern recognition tutorial

The pattern recognition approach is based on a technique developed by Fukunaga and Mantock.<sup>45</sup> We do not describe the technique in detail here, for that is done in the referenced journal article. Rather, we illustrate its application with three tutorial illustrations to allow the reader to understand how to interpret the results related to characteristics underlying incidents of violence involving sailors.

As noted in the main body of this report, desirable features of the technique include:

- Multiple dimensions are included. Thus, one application can encompass multiple factors such as time of incident, location of incident, ages/genders/races of perpetrators and victims, alcohol involvement, severity of violence, etc.
- The approach is non-parametric. This means that there are no underlying assumptions about the statistical distributions of the data.
- While encompassing multiple dimensions, the “patterns” are displayed in two dimensions, allowing humans to use their cognitive abilities to “see” the degree of differences between two populations.
- The two-dimensional patterns are readily transformed into estimated probabilities of misclassification – in essence the classical tradeoffs between “false negatives” and “false positives.”

For each application, the comparison is between two populations, generically labeled as “red population” and “blue population.”

### A.1 Pattern recognition of clearly separable populations

For the first example, suppose that we have a single database that records certain data on 100 people drawn from two populations, [professional jockeys](#) (red population) and [professional basketball players](#) (blue population). The data recorded for each person includes age, education, income, height, and weight, but database itself does not record the *profession* of each person.

Thus, the question is whether we can infer the profession of the individuals, based upon the data. Because the data includes heights and weights, it is clear that any viable pattern recognition technique ought to clearly see them as two distinct groups, and our technique does.

The first “visual display” is a scatter-plot, shown in Figure A-1, where the transformed data<sup>46</sup> from each of the two populations gravitate to opposite corners of the plots. Because of this graphical polarization, we can visually see that the transformed data

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<sup>45</sup> K. Fukunaga and J.M. Mantock, *A non-parametric two-dimensional display for classification*, IEEE Transactions on Pattern Analysis and Machine Intelligence, PAMI 4.4, 1982, pp 427-436.

<sup>46</sup> The data is “transformed from multiple dimensions into two dimensions. For our purposes, it is not necessary to explain the strange logarithmic scales of the axes. Instead, we only care that there is a way to visually see how different two populations can be made to look.

recognizes the significant differences between the two populations. In the scatter-plot, the 45-degree lines are simply a visual reference – separation between the populations is judged by how many data points are on the “wrong side” of a line. However, it is important that the lines of separation are 45-degrees, which is why the graph is displayed as a square.

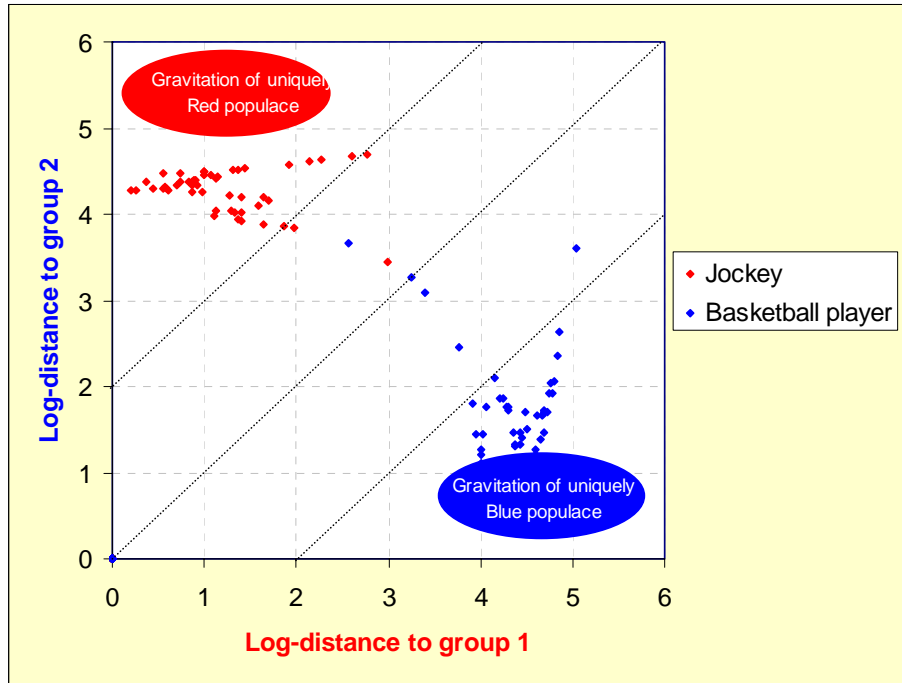


Figure A-1. Scatter-plot that distinguishes two clearly separable populations

There is another, more useful, way to view the pattern data. We generate Figure A-2 by sweeping through the entire set of data with a series of 45-degree lines and counting the number of data points of each population that are on the “wrong side.” This display is a traditional “operating curve” that traces the empirically estimated probabilities of error. It will look familiar to sensor operators who make tradeoffs between the probability of false alarms and the probability of missed detections. For those tradeoffs, if one is willing to accept a high false alarm rate, there will be few missed detections; conversely, if one is not willing to accept a high false alarm rate, many opportunities for detection will be missed.<sup>47</sup>

<sup>47</sup> For sensors, if there is a very high signal-to-noise ratio, then the two “populations” – real targets and false targets – are easily separated, leading to low probabilities for both types of error.

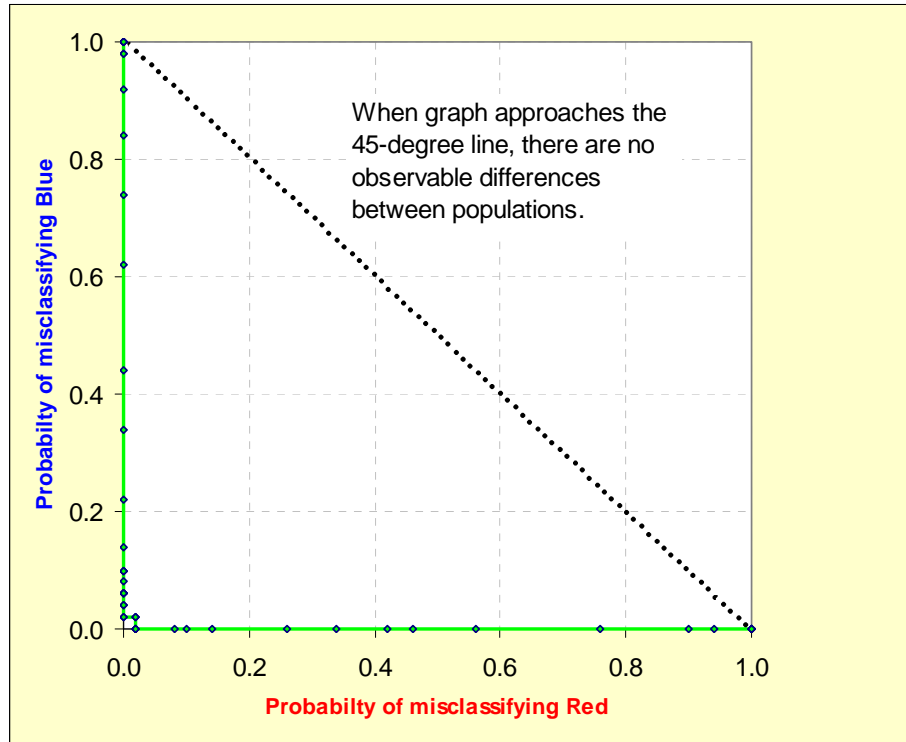


Figure A-2. Operating curve that distinguishes two clearly separable populations

For this graph, the (negatively inclined) 45-degree line corresponds to no observable differences between populations.<sup>48</sup> However, it is possible to have nearly zero chance of misclassifying the member’s home population because our [jockey](#) and [basketball player](#) populations are so clearly divided – the only doubt comes from a couple of relatively small basketball players. The operating curve reflects this by nearly tracing the axes and deviating from them only near the origin.

## A.2 Pattern recognition of marginally separable populations

The second tutorial takes data from two populations where there is more overlap in the data: [men](#) (red population) and [women](#) (blue population). Again, suppose that we have various data on members of these two populations, such as age, education, and height, but that *gender* is not in the recorded data.

Under these circumstances, it is impossible to determine with absolute certainty the gender of a person upon learning the associated information on file. Yet, we could still form an “educated guess” primarily based upon height data. While this educated guess could clearly be wrong for one individual (e.g., a very tall woman or a very short man), when applied to a large population, we would right more often than we were wrong. That is the best that we can hope to accomplish from the limited data.

<sup>48</sup> For example if the populations were indistinguishable and 20 (or 40, or 60) percent of the red population was on one side, then we would expect that 80 (or 60, or 40) percent of the blue population would be on the other side.

The general separation is seen in the scatter-plot of Figure A-3 but there is considerable overlap, with several points from each population on the “wrong side” of the 45-degree line.<sup>49</sup> Likewise in the operating curve, Figure A-4, there are considerably higher probabilities of incorrect classification than were seen in the first example, yet the curve still bends downward from the (negatively inclined) 45 degree line.

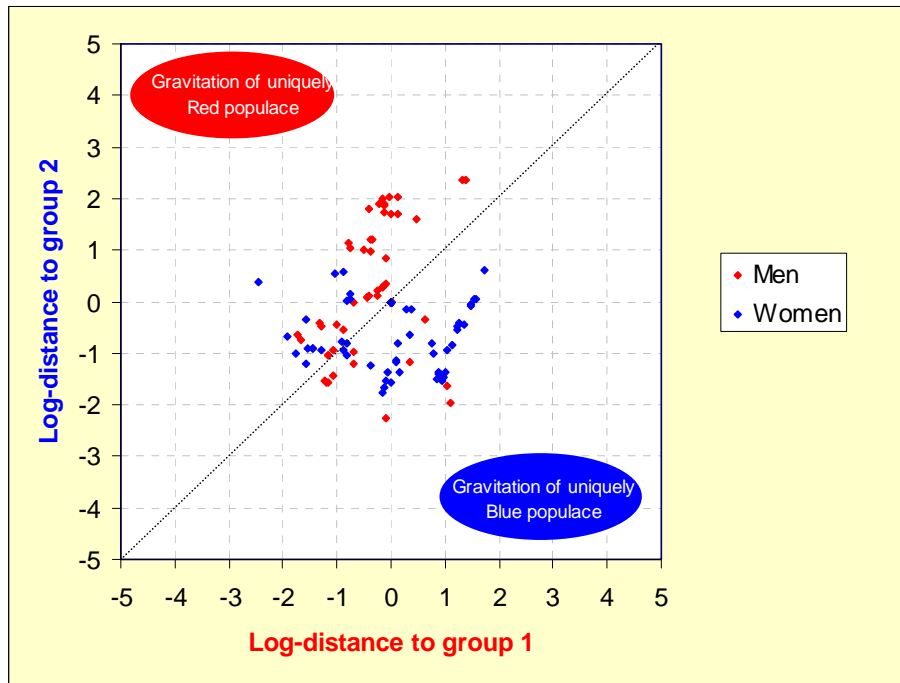


Figure A-3. Scatter-plot that distinguishes two marginally separable populations

<sup>49</sup> Only a single 45-degree reference line is drawn here, but others could be drawn with the same effect.

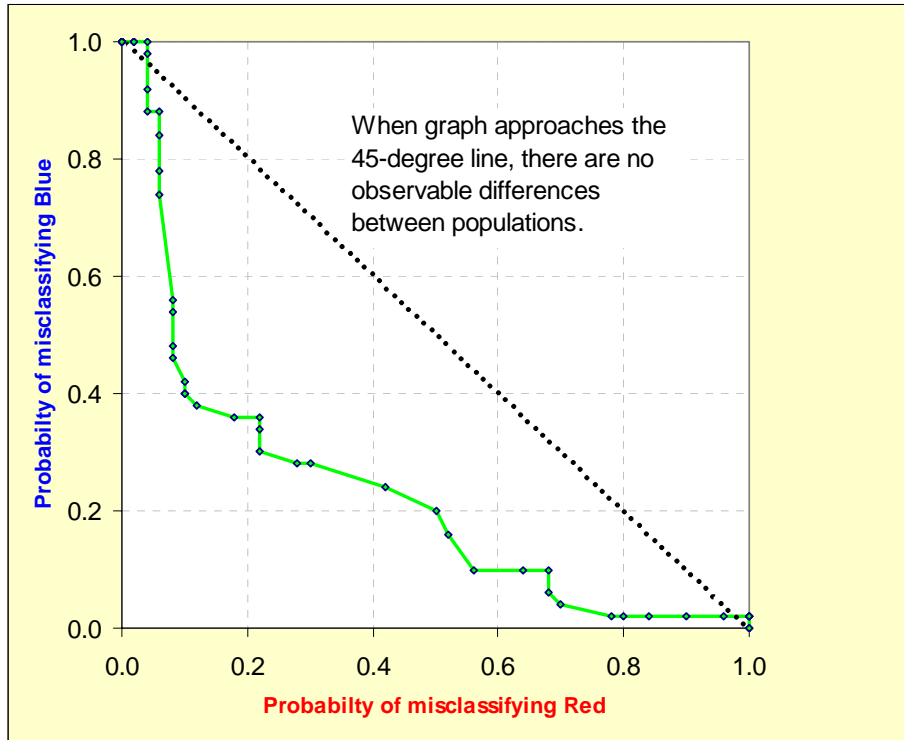


Figure A-4. Operating curve that distinguishes two marginally separable populations

### A.3 Pattern recognition of statistically identical populations

The third and final example takes data from two populations that are statistically identical: the **red** population consists of 50 random numbers from a standard Gaussian distribution and the **blue** population consists of 50 different random numbers from the same distribution.

The purpose of this example is to see what how patterns would look when there are no statistical differences between the populations. Figures A-5 and A-6 illustrate the resultant patterns. Of note, the operating curve in Figure A-6 tends to align with the 45-degree line indicating no statistical differences.

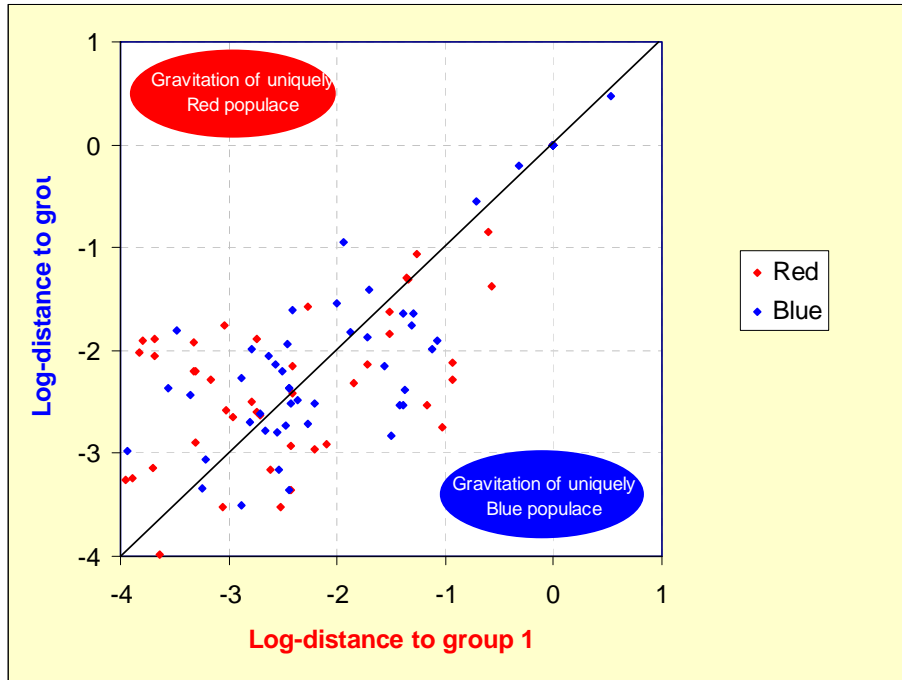


Figure A-5. Scatter-plot for two statistically identical populations

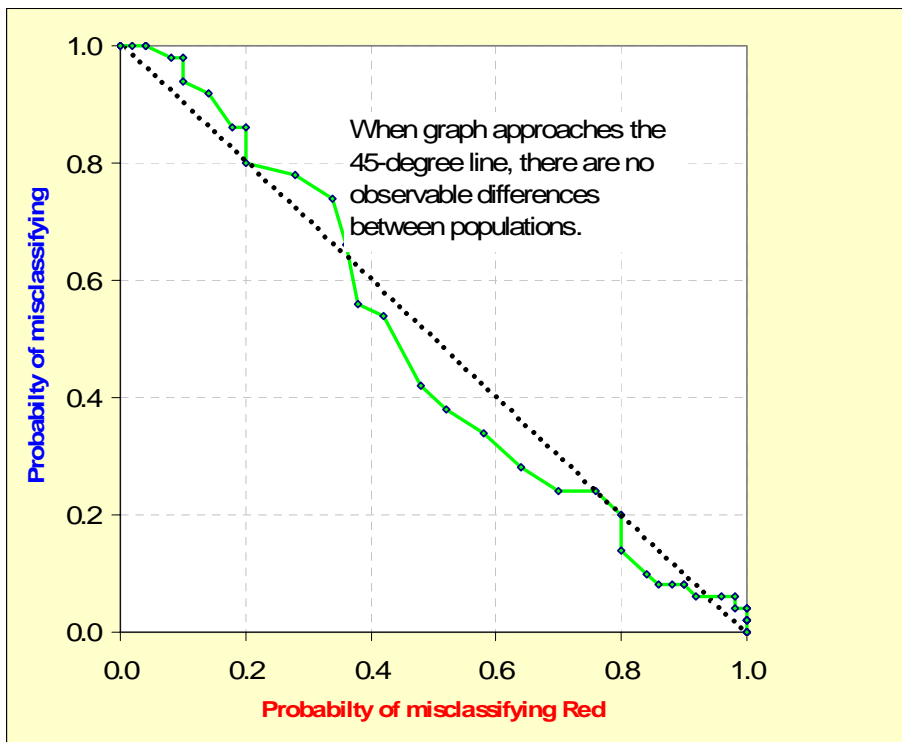


Figure A-6. Operating curve for two statistically identical populations

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