2011 National Clinical Alarms Survey:

Perceptions, Issues, Improvements, and Priorities of Healthcare Professionals

A project of the

HTF

HealthcareTechnology FOUNDATION

Sponsored by

AAMI Advancing Safety in Medical Technology

ACCE American College of Clinical Engineering

PHILIPS

Background

In 2005-6, the Healthcare Technology Foundation (HTF) performed a national survey of clinical alarm issues receiving 1327 responses from healthcare personnel. The initial survey received the support of a diverse group of organizations resulting in strong response from nursing and other staff in acute care hospitals. The results were incorporated into a white paper – **Impact of Clinical Alarms on Patient Safety**. Peer review papers were also published with complete references found at the HTF Clinical Alarms website http://thehtf.org/clinical.asp.

HTF conducted a re-survey of the healthcare field to determine changes in the profession's perception of clinical alarm issues, improvements made at their facilities, and priorities for future action. The re-survey took place over the period August 8 – September 10, 2011.

Survey Team

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Supporting organizations

The following organizations supported the survey by making members, subscribers, and other stakeholders aware of the survey:

- Association for the Advancement of Medical Instrumentation (AAMI)
- American College of Clinical Engineering (ACCE)
- American Association for Respiratory Care (AARC)
- American Association of Critical-care Nurses (AACN)
- Food & Drug Administration/MEDSUN
- ECRI Institute
- Medical Equipment & Technology Association (META)
- Department of Veterans Administration
- 24x7 Magazine

Survey Results

The following pages summarize the overall survey results with a comparison between the 2006 and 2011 surveys. Also, a section is included showing results filtered by title and response to certain questions. Key results and recommendations are on page 10.

Results

Demographics

- 4,278 responded to survey with 81% going through the survey and clicking ***Done***
- Nearly all responses are from acute care hospitals
- There was a strong response from the ICU area. Respiratory was not included as a choice on the survey. However, the **Other** category registered 1348 write-in responses including 700 entries of Respiratory, Respiratory Care or Respiratory Therapy. These were identified and subtracted from the **Other** total. See Chart 1.
- A huge response was received by Respiratory Therapists with Chart 2 showing their high interest in this topic. Nursing also had a high response with 1650 responses from RN, LPN, nursing aides, and clinical managers.
- More than three-quarters of all responders are experienced staff with 91% of the clinical managers with 11 or more years of experience.

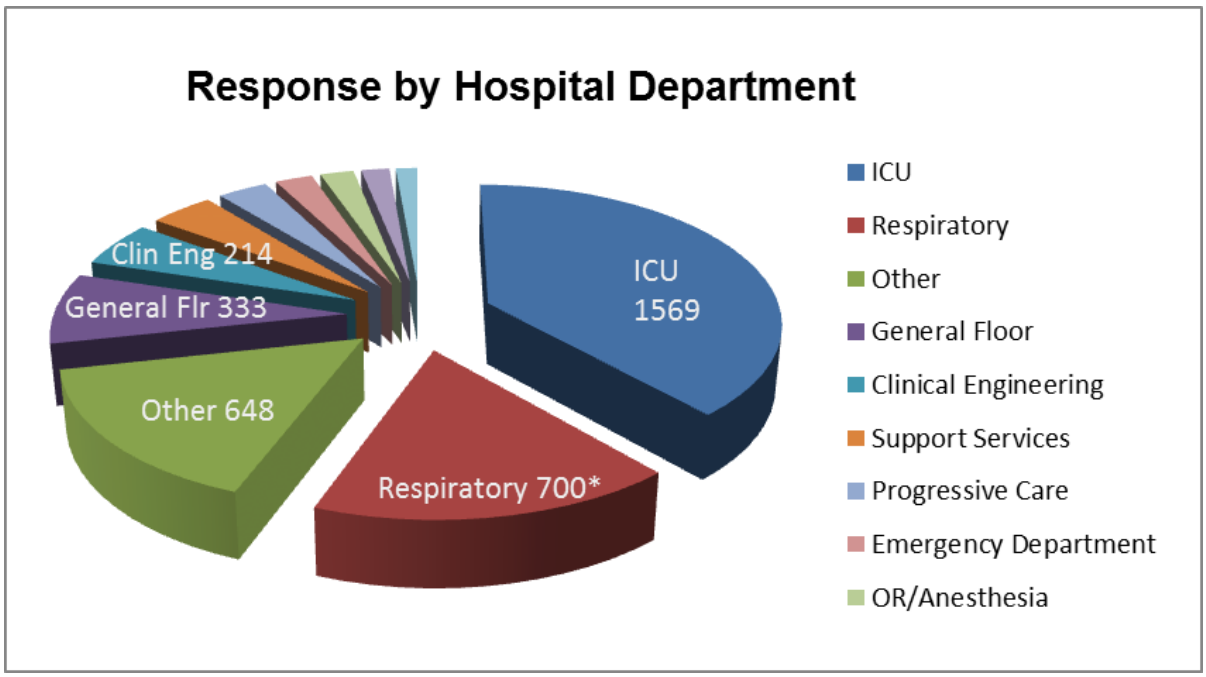


Chart 1

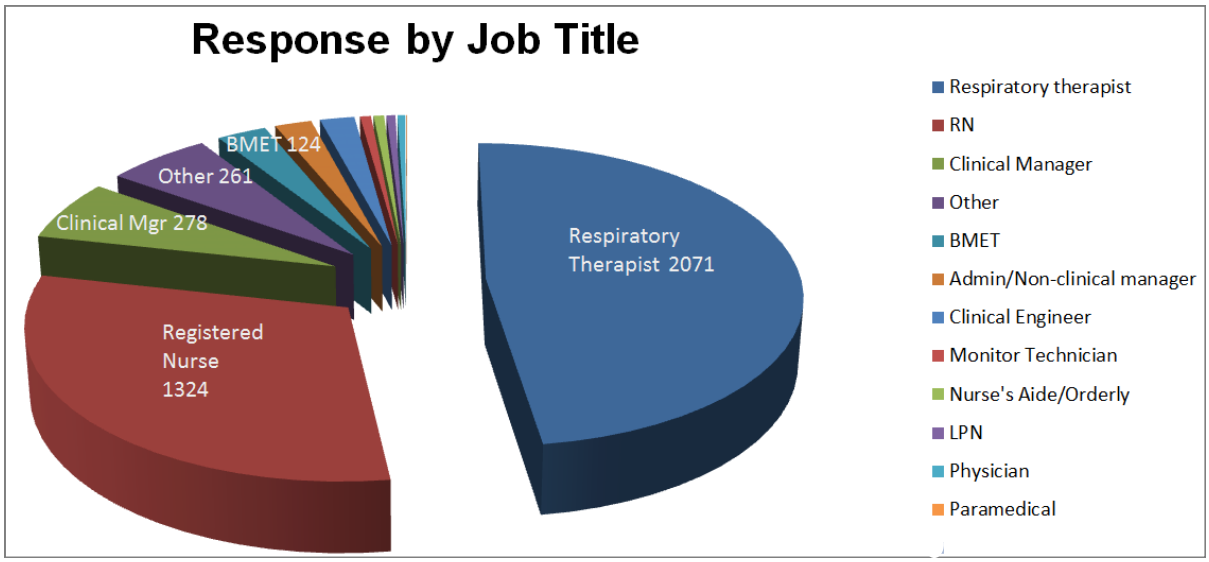


Chart 2

Results: Questions 5-27

A sample response to a survey question is shown to the right.

The overall results are shown in five color coded categories in Table 1 below. **The responses *Strongly Agree and Agree* have been added together to develop summary rated according to agreement with each question.**

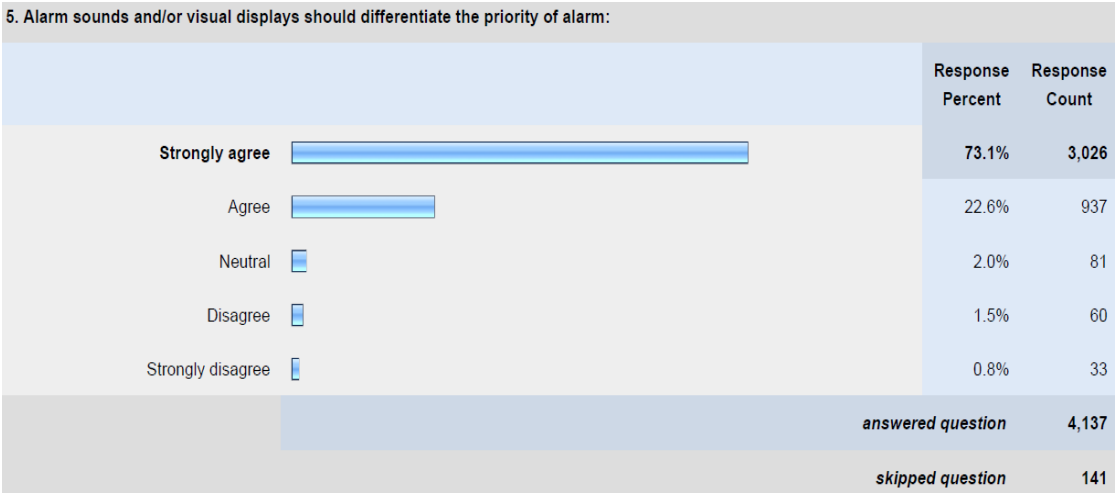


Table 1: Summary - Questions 5-27

Question	Results: *Strongly Agree % + Agree % Responses*
5. Alarm sounds and/or visual displays should differentiate the priority of alarm	Very high agreement Greater than 90%
6. Alarm sounds and/or visual displays should be distinct based on the parameter (e.g. heart rate) or source (device type):	Very high agreement Greater than 90%
7. Nuisance alarms occur frequently	High agreement 66 – 89%
8. Nuisance alarms disrupt patient care	High agreement 66 – 89%
9. Nuisance alarms reduce trust in alarms and cause caregivers to inappropriately turn alarms off at times other than setup or procedural event	High agreement 66 – 89%
14. The alarms used on my floor/area of the hospital are adequate to alert staff of potential or actual changes in a patient's condition	High agreement 66 – 89%
17. Clinical staff is sensitive to alarms and responds quickly	High agreement 66 – 89%
18. The medical devices used on my unit/floor all have distinct outputs (i.e., sounds, repetition rates, visual displays, etc.) that allow users to identify the source of the alarm	High agreement 66 – 89%
24. Smart alarms (e.g., where multiple parameters, rate of change parameters, and signal quality are automatically assessed in their entirety) would be effective to use for reducing false alarms	High agreement 66 – 89%
25. Smart alarms (e.g., where multiple parameters, rate of change of parameters, and signal quality are automatically assessed in their entirety) would be effective to use for improving clinical response to important patient alarms	High agreement 66 – 89%
27. There is a requirement in your institution to document that the alarms are set and are appropriate for each patient	High agreement 66 – 89%
19. When a number of devices are used with a patient, it can be confusing to determine which device is in an alarm condition	Majority agree 50-65%
21. Central alarm management staff responsible for receiving alarm messages and alerting appropriate staff is helpful	Majority agree 50-65%
23. Alarm integration and communication systems via pagers, cell phones, and other wireless devices are useful for improving alarms management and response	Majority agree 50-65%
26. Clinical policies and procedures regarding alarm management are effectively used in my facility	Majority agree 50-65%
13. The integration of clinical alarms into the Joint Commission patient measures, have reduced patient adverse events	Low agreement 33-49%
20. Environmental background noise has interfered with alarm recognition	Low agreement 33-49%
11. Properly setting alarm parameters and alerts is overly complex in existing device	Very low agreement 0 – 33%
12. Newer monitoring systems (e.g. <3 years old) have solved most of the previous problems we experienced with clinical alarms	Very low agreement 0 – 33%
15. There have been frequent instances where alarms could not be heard and were missed	Very low agreement 0 – 33%

Results: Comparison Between 2006 and 2011 Surveys

Demographics

1. Facility type— similar results with Acute Care Hospitals—93.8% in 2006 and 97.1% in 2011
2. Hospital department—similar results for the top department ICU—31.1% in 2006 and 38.5% in 2011. The data extraction from the **Other** category found 17.2% of the responses from Respiratory. There was a slight drop in General Floor responses from 11.1% to 8.2%. The other areas were similar and below 10%.
3. Titles—the percent response from RNs dropped—51.1% in 2006 and 32.5% in 2011 while Respiratory Therapy increased—14.1% to 50.9%. Clinical engineer and BMET both dropped in percentage response—5.9%/8.6% in 2006 and 2.1%/3% in 2011 respectively.
4. Healthcare experience—Similar results with an increase in experience level for 11+ years—65.8% in 2006 and 78.8% in 2011

Questions 5-27 — The questions shown in Table 2 were the same in both the 2006 and 2011 surveys. The comparison of *Strongly Agree and Agree* percentages shows similar results except questions 7, 8, & 11 (improvement) and 26 & 27 (less compliance) show a 5% or greater difference.

Table 2		
Question	**2006**	**2011**
5. Alarm sounds and/or visual displays should differentiate the priority of alarm:	95%	96%
6. Alarm sounds and/or visual displays should be distinct based on the parameter (e.g. heart rate) or source (device type):	94%	91%
7. Nuisance alarms occur frequently:	81%	76%
8. Nuisance alarms disrupt patient care:	77%	71%
9. Nuisance alarms reduce trust in alarms and cause caregivers to inappropriately turn alarms off at times other than setup or procedural events:	78%	78%
11. Properly setting alarm parameters and alerts is overly complex in existing devices:	28%	21%
12. Newer monitoring systems (e.g. <3 years old) have solved most of the previous problems we experienced with clinical alarms:	31%	29%
14. The alarms used on my floor/area of the hospital are adequate to alert staff of potential or actual changes in a patient's condition:	72%	72%
15. There have been frequent instances where alarms could not be heard and were missed:	30%	29%
17. Clinical staff is sensitive to alarms and responds quickly:	63%	66%
18. The medical devices used on my unit/floor all have distinct outputs (i.e., sounds, repetition rates, visual displays, etc.) that allow users to identify the source of the alarm:	69%	70%
19. When a number of devices are used with a patient, it can be confusing to determine which device is in an alarm condition:	51%	51%
20. Environmental background noise has interfered with alarm recognition:	43%	42%
21. Central alarm management staff responsible for receiving alarm messages and alerting appropriate staff is helpful:	49%	53%
23. Alarm integration and communication systems via pagers, cell phones, and other wireless devices are useful for improving alarms management and response:	54%	56%
24. Smart alarms (e.g., where multiple parameters, rate of change parameters, and signal quality are automatically assessed in their entirety) would be effective to use for reducing false alarms:	80%	78%
25. Smart alarms (e.g., where multiple parameters, rate of change of parameters, and signal quality are automatically assessed in their entirety) would be effective to use for improving clinical response to important patient alarms:	80%	78%
26. Clinical policies and procedures regarding alarm management are effectively used in my facility:	66%	55%
27. There is a requirement in your institution to document that the alarms are set and are appropriate for each patient:	76%	71%

Results: Comparison Between 2006 and 2011 Surveys

The results for the 2006 survey for Question 35—Ranking Priorities—are shown below in Table 3 and Chart 3.

7. Please read each of the following nine issues before starting to rank them. Then click 1 for the most important issue, 2 for the next most important issue, and so on to 9 for the least important issue.

	1	2	3	4	5	6	7	8	9	Response Average
Difficulty in setting alarms properly.	9% (83)	8% (78)	11% (109)	9% (89)	12% (119)	8% (80)	13% (123)	13% (124)	**16% (154)**	**5.46**
Difficulty in hearing alarms when they occur.	8% (71)	10% (98)	10% (95)	**14% (133)**	13% (118)	14% (128)	14% (129)	11% (102)	7% (66)	**5.06**
Difficulty in identifying the source of an alarm.	5% (47)	11% (106)	15% (145)	15% (143)	**16% (151)**	14% (132)	11% (102)	8% (71)	5% (47)	**4.79**
Difficulty in understanding the priority of an alarm.	7% (61)	13% (120)	15% (140)	**18% (167)**	15% (145)	14% (133)	9% (84)	6% (57)	3% (30)	**4.51**
Frequent false alarms, reducing attention/response to alarms that occur.	**42% (404)**	15% (145)	11% (105)	10% (93)	7% (71)	6% (59)	4% (41)	2% (24)	2% (23)	**2.88**
Inadequate staff to respond to alarms as they occur.	12% (113)	**14% (129)**	10% (99)	8% (79)	11% (101)	11% (102)	10% (97)	11% (107)	13% (128)	**5.01**
Over-reliance on alarms to call attention to patient problems.	11% (108)	**16% (157)**	14% (136)	11% (104)	10% (100)	12% (119)	11% (103)	9% (86)	5% (53)	**4.50**
Noise competition from non-clinical alarms and pages.	3% (25)	8% (77)	9% (85)	9% (86)	9% (85)	11% (103)	16% (155)	**18% (177)**	18% (176)	**6.09**
Lack of training on alarm systems.	8% (79)	7% (66)	7% (69)	7% (73)	7% (74)	9% (93)	10% (103)	19% (184)	**25% (247)**	**6.13**
									Total Respondents	**1050**
									(skipped this question)	**277**

Table 3

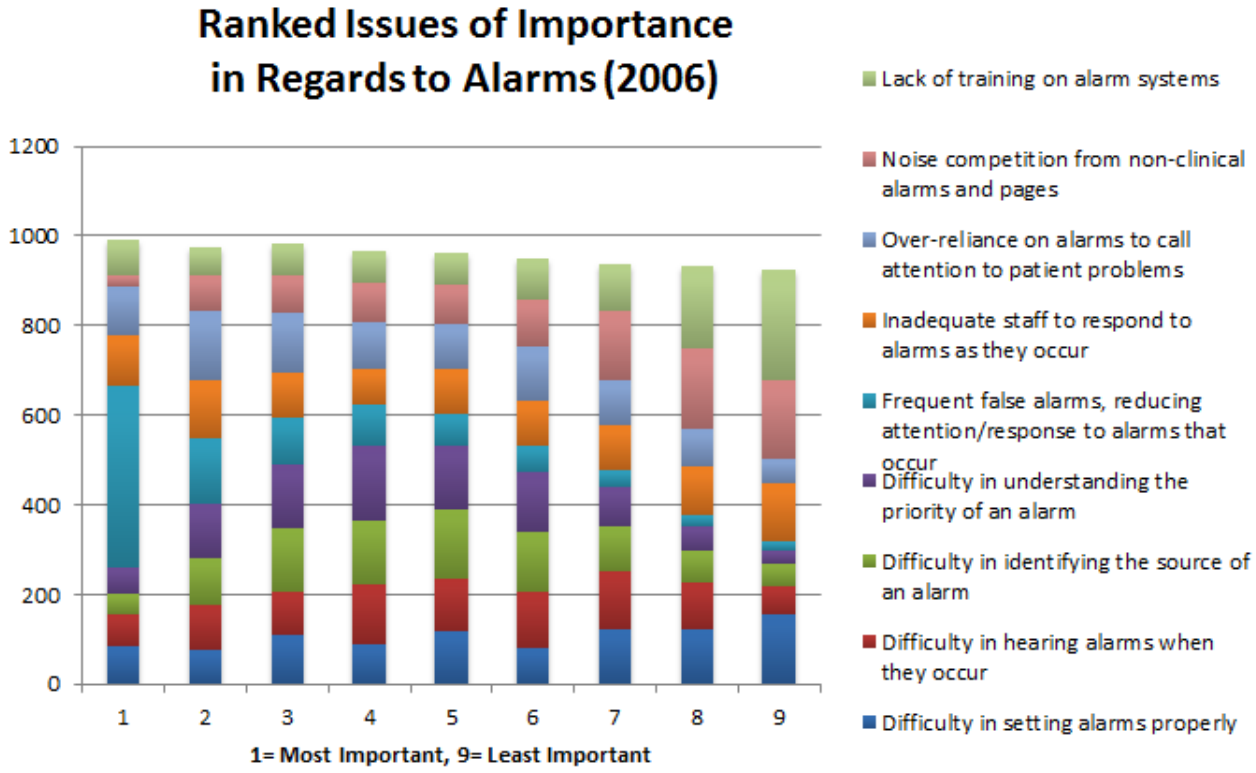


Chart 3

Results: Comparison Between 2006 and 2011 Surveys

The results for the 2011 survey for Question 35—Ranking Priorities—are shown below in Table 4 and Figure 4.

35. Please rank the following issues below concerning alarms; 1=Most important, 9=Least important. Read ALL ISSUES FIRST, then rank each issue with only one ranking. You will be able to adjust the ranking during the process. Create Chart Download

	1: Most important	2	3	4	5	6	7	8	9: Least important	Rating Average	Response Count
Difficulty in setting alarms properly:	8.8% (246)	9.4% (262)	9.7% (271)	10.1% (280)	12.9% (359)	10.9% (305)	12.0% (334)	11.6% (324)	**14.5% (405)**	1.00	2,786
Difficulty in hearing alarms when they occur:	11.5% (317)	14.1% (387)	13.6% (373)	**14.4% (397)**	11.7% (321)	10.9% (301)	10.1% (278)	9.2% (252)	4.5% (124)	1.00	2,750
Difficulty in identifying the source of an alarm:	7.0% (191)	13.3% (363)	**17.2% (467)**	14.9% (406)	13.6% (370)	12.2% (332)	11.4% (309)	6.7% (181)	3.7% (102)	1.00	2,721
Difficulty in understanding the priority of an alarm:	8.7% (241)	12.9% (357)	14.3% (397)	**16.4% (456)**	14.5% (404)	13.2% (366)	9.2% (256)	6.7% (187)	4.1% (113)	1.00	2,777
Frequent false alarms, which lead to reduced attention or response to alarms when they occur:	**33.3% (964)**	15.4% (447)	11.7% (338)	9.7% (282)	11.4% (330)	6.5% (187)	4.4% (127)	4.6% (134)	2.9% (85)	1.00	2,894
Inadequate staff to respond to alarms as they occur:	**14.5% (416)**	13.8% (394)	9.9% (284)	10.1% (288)	9.6% (275)	11.5% (330)	9.4% (270)	10.4% (298)	10.8% (310)	1.00	2,865
Over reliance on alarms to call attention to patient problems:	10.7% (308)	14.0% (403)	13.9% (400)	10.4% (300)	10.2% (293)	11.5% (333)	**14.8% (426)**	9.1% (263)	5.5% (159)	1.00	2,885
Noise competition from non-clinical alarms and pages:	3.2% (95)	6.3% (187)	7.9% (233)	9.0% (267)	9.1% (270)	10.8% (320)	13.2% (391)	18.7% (554)	**21.8% (646)**	1.00	2,963
Lack of training on alarm systems:	8.6% (269)	7.0% (217)	7.8% (243)	7.6% (237)	8.8% (275)	9.2% (285)	11.4% (356)	16.6% (516)	**22.9% (712)**	1.00	3,110
									answered question		3,307
									skipped question		971

Table 4

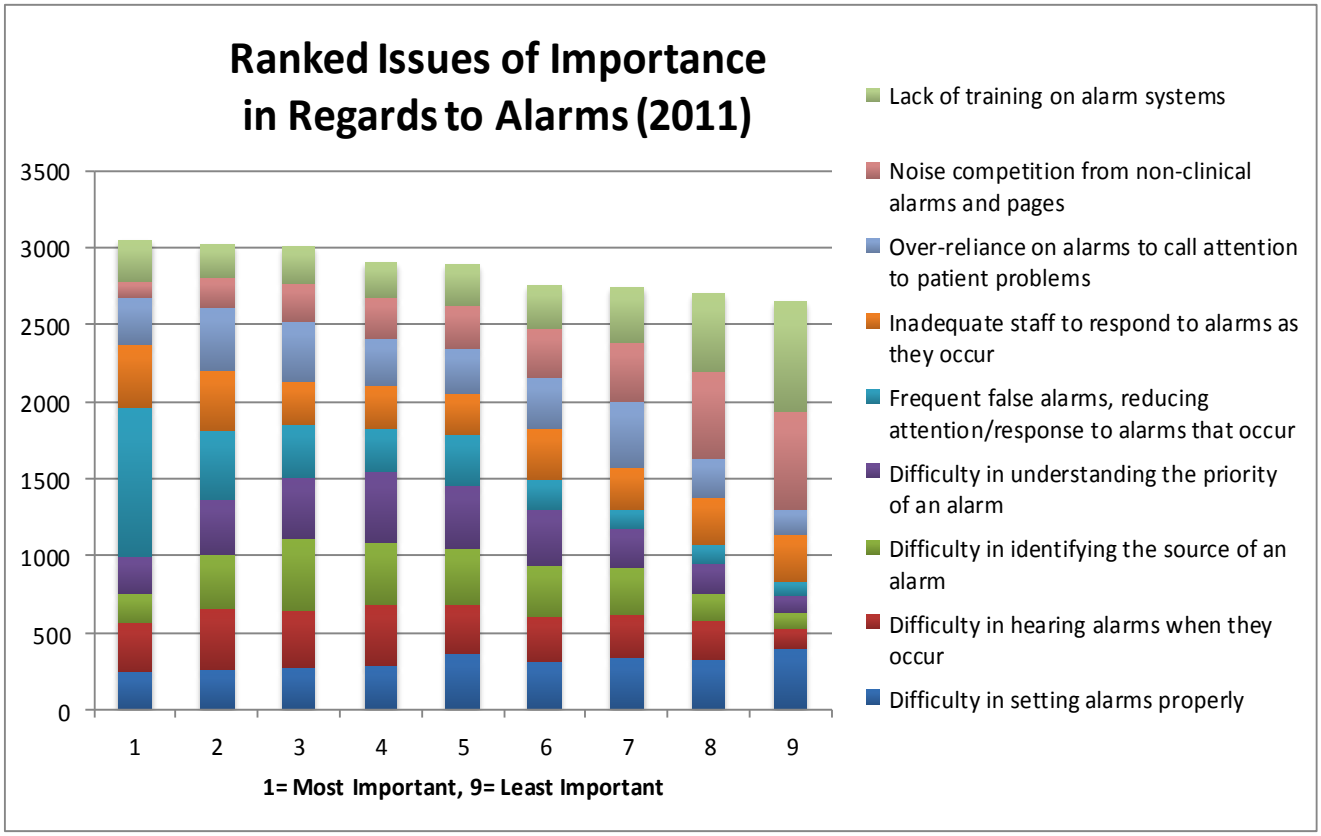
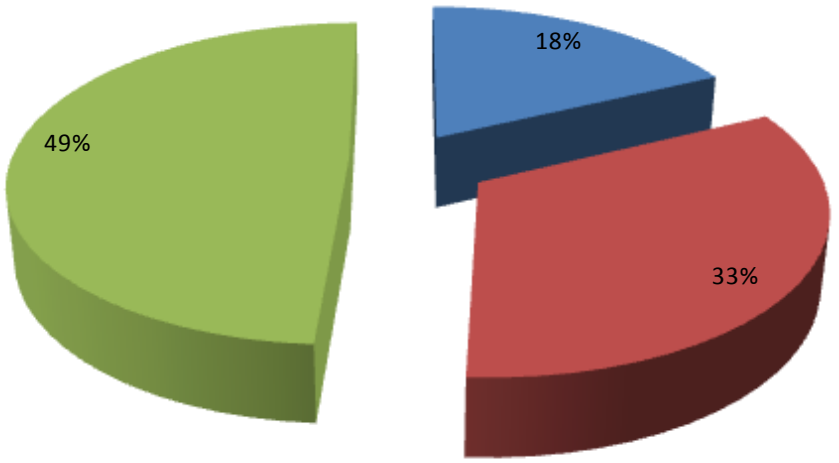


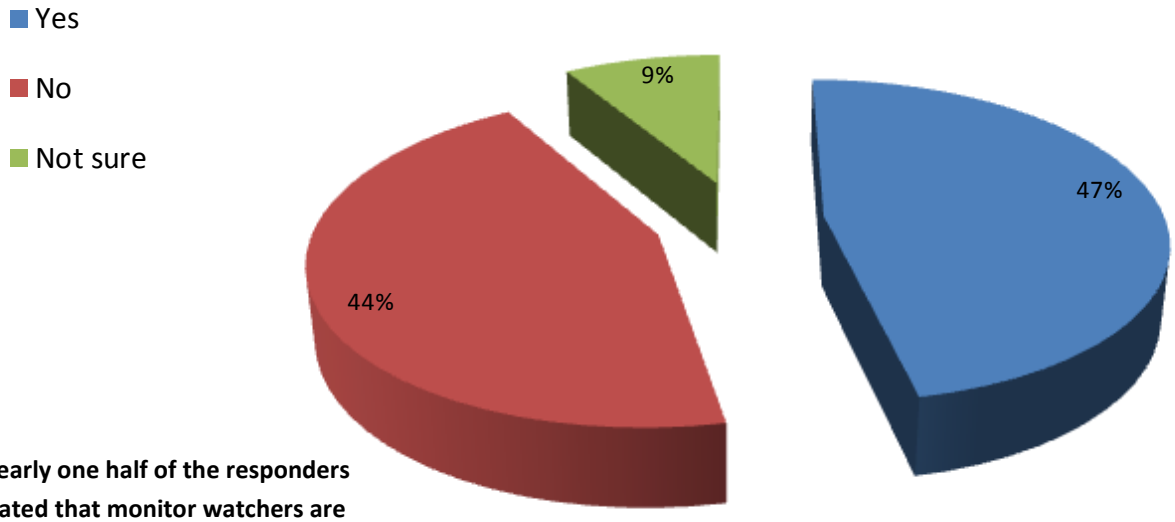
Chart 4

Has your institution experienced adverse patient events in the last two years related to clinical alarm problems? #29



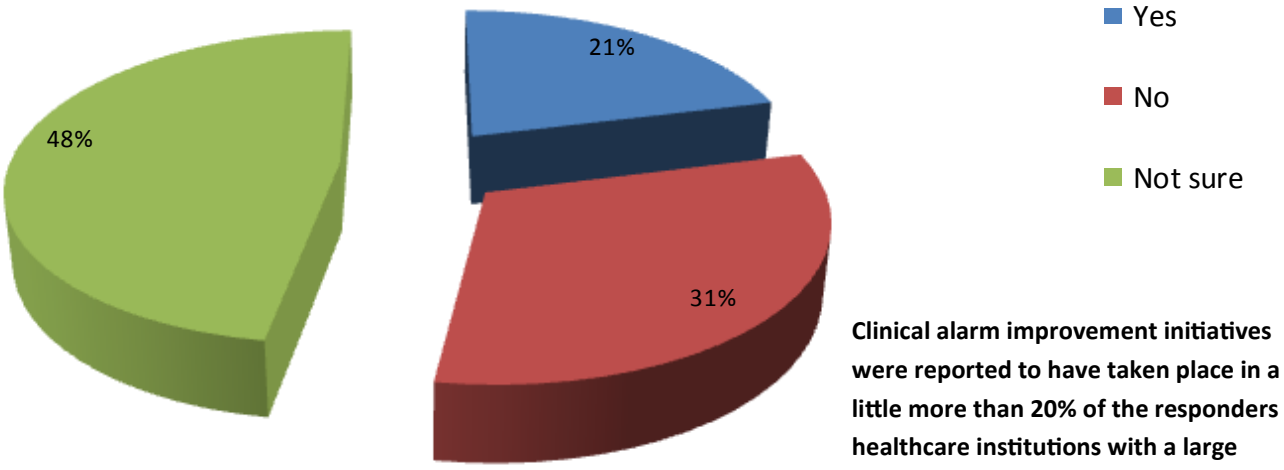
The results show almost 1 in 5 institutions experiencing adverse patient events over the last two years with a large percentage unsure if events had occurred.

Does your institution utilize "monitor watchers" in a central viewing area to observe and communicate alarm conditions to caregivers? #30



Nearly one half of the responders stated that monitor watchers are used in their institution.

Has your institution developed clinical alarm improvement initiatives over the past two years? #31



Clinical alarm improvement initiatives were reported to have taken place in a little more than 20% of the responders healthcare institutions with a large percentage unsure of this activity.

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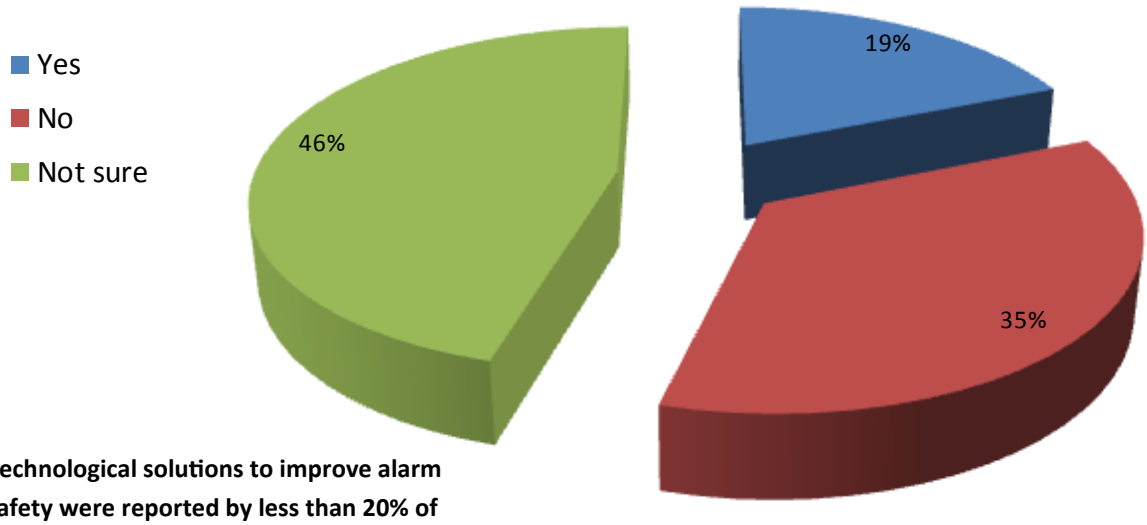
Has your healthcare institution instituted new technological solutions to improve clinical alarm safety? #33



Technological solutions to improve alarm safety were reported by less than 20% of the responders with a large percentage unsure of this activity.

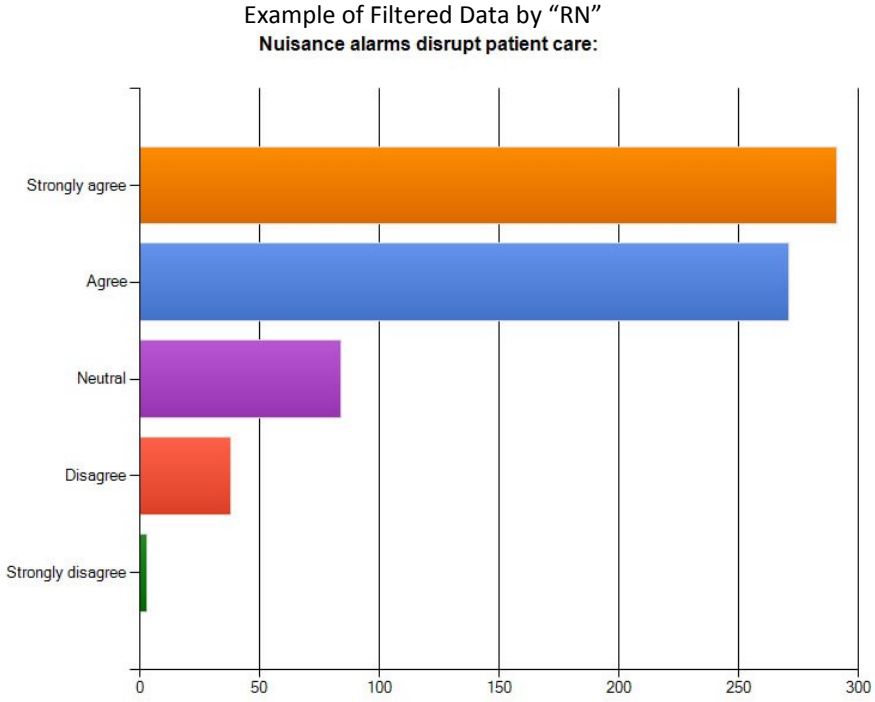
Results: Key Points from Filtered Data for 2011 Survey

Question 6 - Alarm Parameter differentiations – 91.6% agreed or strongly agreed (affirm) with this need with the ranging from 91.2% for Respiratory Therapists to 96.1% for Monitor Techs.

Question 7 - Nuisance alarms frequent – 75.5% affirm this concern with the highest positive response from RNs at 84.2% with Respiratory Therapists at 71.5%

Question 9 - Nuisance alarms reduce trust – 77.5% affirm this statement with the highest agreement from clinical managers at 81.8% with respiratory therapists at 75.5%

Example of Filtered Data by "RN"



In the submitted comments, Respiratory Therapists feel that nuisance alarms should all be investigated and defend the reasoning behind alarms. However, they also feel that proper alarm setting by patient condition would improve the potential of nuisance alarms. Often their procedures. I.e. ventilator weaning and treatments cause alarms which can only be silenced for short periods causing further desensitization. Also, most of the concerns regarding annunciation of alarms were outside the ICU setting or in isolation rooms or other locations where closed doors or proximity from the nurse station would prevent alarms from being heard and responded.

Question 23—Alarm integration useful— *In the submitted comments, Respiratory Therapists stated anxiety about further integration that could potentially make the problem worse. "Alarms for alarms, really?!" The way the integration is designed and implemented governs the opportunity for remedy.*

Question 26 - Clinical policies effectively used – the majority agree or strongly agree with this statement. Respiratory Therapists affirmed that policies and documentation were followed with a 75% response of Strongly Agree or Agree. 20.5% of RNs disagree with the statement. This title showed the highest level of disagreement.

Question 27 - Requirement to document alarm setting – 71.1% affirm this statement. Regarding responder titles, 23.4% of RNs disagree with the statement. This title showed the highest level of disagreement.

Question 35 - Prioritize the issues with clinical alarms – the highest priority issue by far is frequent false alarms. Inadequate staffing, difficulties in hearing and identifying alarms, and over reliance on alarms round out the top five priorities. Lack of training and noise competition are low priorities.

In terms of responses by titles, inadequate staffing was a high priority except for clinical managers who rated it as a low priority. Conversely, clinical managers rated overreliance on alarms as a high priority while RN, LPN and respiratory staff rated it low priority.

Key Results and Recommendations

1. A high priority must be placed on the reduction of nuisance alarms. Manufacturers, clinicians, healthcare leadership, government agencies, and clinical engineering must focus on this area. As has been discussed in numerous professional and lay press articles, nuisance alarms lead to alarm fatigue and adverse events.
2. The very high level agreement with Question 6 — *"Alarm sounds and/or visual displays should be distinct based on the parameter or source."* points to consideration by standards organizations to discuss this requirement for future systems.
3. Smart alarms are viewed as being advantageous in reducing false alarms and improving response to alarms. This area needs novel solutions to develop new methods that leap frog current technology.
4. Central alarm management is viewed as advantageous and many institutions utilize monitor watchers. Hospitals should consider this approach in the developing alarm strategies.
5. Clinical alarm improvement efforts need to be stepped up in healthcare institutions. The responses show a minority of hospitals addressing this need.
6. Adverse events related to clinical alarm issues were reported by 1 in 5 responders. This causative factor of adverse events may not be fully reported to the FDA.
7. A large proportion of the responders were unsure if adverse events had occurred in the last 2 years and unsure if there had been new solutions to improve alarm safety at their facility. Improved and open communication is needed in healthcare related to these critical issues.
8. A systems approach is needed to address the complexities of clinical alarm issues in healthcare. The effort needs to involve all stakeholders in developing solutions.

HTF Healthcare Technology FOUNDATION

The mission of HTF is to:

> ***"Improve healthcare delivery outcomes by promoting the development, application and support of safe and effective healthcare technologies."***

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