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Sent: Tuesday, March 22, 2011 3:55 PM
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Cc: Smith, Dianne [BOARD]; Donley, Bob [Regents]
Subject: Attached summary and report
Attachments: Executive Summary - Rhabdo Report.pdf; Final Report on Rhabdo incident.pdf

On behalf of Bob Donley:

Attached please find the Executive Summary and the Final Report of the root cause analysis regarding the hospitalization of the University of Iowa football players.

This information is embargoed until tomorrow's official release following the report by President Mason and the committee during the Board meeting.

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"The main thing is to keep the main thing the main thing!" -- Stephen Covey

REPORT OF THE SPECIAL PRESIDENTIAL COMMITTEE TO INVESTIGATE THE JANUARY 2011 HOSPITALIZATION OF UNIVERSITY OF IOWA FOOTBALL PLAYERS

BACKGROUND

The Committee was first convened by University of Iowa President Sally Mason on February 4, 2011, at which point it was formally charged to investigate the rhabdomyolysis (hereinafter rhabdo) symptoms diagnosed in University of Iowa (UI) football players, leading to the hospitalization of 13 student athletes on January 24 and 25, 2011. The committee was directed to make a thorough investigation of the incident and to report our findings and recommendations to the President by March 23, 2011. The Committee adopted as its basic premise that ensuring the safety, health and welfare of student athletes competing on behalf of the University of Iowa is a primary concern of the University and its Athletics Department.

OFF-SEASON FOOTBALL TRAINING

In collegiate football today, the players train and work on strength and conditioning year-round. Much of the improvement in football players' strength, speed, endurance, and position skills comes as the result of off-season training and conditioning. This is certainly true at UI, where the strength and conditioning program is nationally known for its success in helping players in many sports achieve their full athletic potential.

A variety of well-defined weight training regimens can increase muscle strength and size. However, exercises involving eccentric contractions (i.e., lengthening of muscle fibers as they contract) such as squats and pull-ups are the most efficient means of improving skeletal muscle strength and hypertrophy (muscle size) optimally. These gains occur when the muscle fiber structure is disrupted (protein degradation) and the muscle fiber proteins are subsequently remodeled (protein synthesis). As muscle tissue naturally repairs itself from repeated stressing, it will enlarge and strengthen, producing greater power and endurance when exercised.

Weightlifting can produce varying degrees of muscle stiffness and soreness depending on the amount of weight lifted, the specific type of exercise performed, the number of repetitions completed, and the individual lifter's training status. However, excessive stress can damage muscle tissue. The line between stress that improves strength and performance and stress that produces excessive muscle damage and accompanying adverse side effects is quite fine and may be difficult to discern because it will vary among athletes and it will vary for a specific athlete over time. Nevertheless athletes, coaches, and training personnel must seek to avoid crossing the line. One of the goals of the current investigation was to identify factors that might have pushed some athletes over the line into a situation where muscle damage was manifested and determine factors that might have kept other athletes on the muscle development side of the line.

WHAT IS RHABDOMYOLYSIS?

Rhabdomyolysis (rhabdo) is a condition that can result from overexertion of skeletal muscle. Rhabdo occurs when muscle tissue is injured to the point that the muscle cells break down and release myoglobin (the oxygen-carrying protein in muscle; myoglobin in the urine causes the brown discoloration associated with rhabdo), enzymes (e.g., creatine kinase [CK]), and electrolytes into the bloodstream. One potential danger associated with rhabdo is that myoglobin leaked by damaged skeletal muscle cells can harm the kidneys, leading to renal failure. Kidney damage is the most common complication of rhabdo. If the condition is not treated properly, electrolytes escaping from damaged muscles cells can also cause heart rhythm disturbances. In addition, muscles can become so swollen that they compress blood vessels and nerves, resulting in a compartment syndrome, which must be treated surgically. Of note, some of the UI football players had transient renal dysfunction but none had cardiac arrhythmias (irregular rhythms) or compartment syndrome.

Rhabdo is a potentially serious health problem for athletes undergoing strenuous workouts that stress large skeletal muscle groups (e.g., quadriceps, the gluteus group), although it is not well known outside of medical circles. Rhabdo was first identified a century ago in association with catastrophes such as earthquakes, rock slides, and building collapses, during which people were crushed by debris. Exertional rhabdo, which is the condition manifested by the UI football players, was recognized more recently. Exertional rhabdo results when specific skeletal muscle groups are stressed during extremely strenuous exercise (e.g., running, weightlifting). There are numerous reports of exertional rhabdo in the medical and scientific literature, most of which describe only one case each. In addition, exertional rhabdo is likely an under-reported phenomenon, as many cases may be confused with delayed onset muscle soreness (DOMS; muscles soreness that typically occurs 24 - 48 hours following strenuous exercise). One expert told a Committee member that, although the true incidence of exertional rhabdo is unknown, the number of cases appears to be increasing substantially in recent years. This may be related, in part, to increased numbers of athletes participating in very strenuous training programs and competitions.

A serum CK level that is more than 5-10 times baseline after vigorous exercise is the primary diagnostic criterion for exertional rhabdo. Patients with exertional rhabdo will also have very sore skeletal muscles. Some will have swollen muscles and many will pass dark, red, or cola colored urine. However, some persons with rhabdo can have high CK levels without changes in urine color, which may, in part, explain why rhabdo is under-recognized.

The 13 UI football players who were admitted to University of Iowa Hospitals & Clinics (UIHC) in late January 2011 were diagnosed by UIHC doctors as suffering from exertional rhabdo. The information the Committee members gathered during the investigation strongly suggests that the intense squat workout team members underwent on January 20, 2011 (described in the "Timeline" section) caused rhabdo in the 13 players who were subsequently hospitalized. Other team members who participated in the workout on January 20, 2011 may have had rhabdo and either chose not to report to the trainers or to respond to a text message that was sent by

trainers to the entire team. It is also possible that some players did not recognize that they had rhabdo because their urine was not brown.

STEPS IN THE COMMITTEE'S INVESTIGATION

The Committee did the following activities to investigate the cluster of rhabdo:

1. Reviewed the medical/scientific literature on rhabdo;
2. Talked with experts on rhabdo;
3. Talked with experts on strength and conditioning;
4. Sent letters to all parents and guardians of football players requesting their input;
5. Interviewed staff of the Athletic Department and the Football Program, including the strength and conditioning coaches and athletic trainers;
6. Interviewed all 13 affected players and some players who were not affected;
7. Conducted an anonymous survey of the football players and analyzed the data;
8. Analyzed data provided by the Football Program;
9. Conducted a short on-line survey with former football players who did similar workouts in 2004 and 2007;
10. Reviewed medical records for 7 of the 13 affected players;
11. Reviewed the results of random drug testing conducted January 21, 2011.

TIMELINE: December 29 to January 31

The Committee developed the following "Timeline" that encompasses the workouts done between January 20 and January 24, 2011, the period preceding these workouts, and the ensuing hospitalizations. This timeline was based on the information gathered during the interviews noted above, including detailed discussions with individual medical, coaching, and training staff members to ensure the accuracy of the information.

Dec. 29 (Tues) – Insight Bowl Football Game, Tempe, AZ

Dec. 30 (Wed) – Football team returned to Iowa City

Dec. 31-Jan. 18 – Winter Break: Current football players were given individualized "Workout Cards" by UI strength and conditioning coaches to guide their training during the last week of the three-week hiatus before students returned for the spring semester. The anonymous survey of the entire team (see subsequent description of this survey) revealed that nearly 70% of the players did 50% or more of their assigned weight lifting and 90% of these players did these lifts at levels of exertion that they deemed to be 'moderate to maximal.'

Jan. 18 (Tues) – Classes resumed at the UI following the winter break and the strength and conditioning coaches convened a team meeting, during which the coaches stressed the

importance of upcoming workouts and noted that these workouts would be very challenging and would demonstrate who wanted to be on the team.

Jan. 19 (Wed) – Before the high-intensity winter workouts were initiated, all players participated in balance and coordination assessment drills ('Functional Movement Screen') to gauge their current level of fitness and conditioning and to determine whether they had developed any physical compensations during the prior season.

Jan. 20 (Thurs) – The first intensive workout was held on this Thursday, with a primary emphasis on large lower-body muscle groups. The workout also included barbell snatches, pull-ups, dumbbell rows, and a weighted sled-pushing exercise in the indoor training "Bubble." Team members could workout at one of three times (6:00 AM, 8:00 AM, or 4:00 PM) during the day, depending on their class schedule. By far the most challenging task in this workout was the assignment to perform 100 back squats with a barbell weighted with 50% of the highest weight lifted from a squat by each player at his last assessment. Players with injuries or specific physical issues were given workouts specifically designed for them. Players were allowed to take as much time as they needed to complete the 100 squats because the goal of the strength and conditioning coaches was to ensure that all players could complete the task, thereby creating a sense of accomplishment for the individual players and for the entire team. Indeed all but one player assigned to do the 100 squats completed the task. The player who did not complete 100 squats had done 95 squats but the coaches stopped him from completing the task because his form was deteriorating to the point that they were concerned he would be injured. Players could take breaks when they chose to do so and some were told by the coaching staff to take breaks when their form broke down. Although the times for completing the squats were not posted and ranked, each player was timed and most players viewed the squats as a competition. (Note: The players view almost all workouts and practices as a competition.) The time needed to complete the 100 squats varied substantially among the players. Some players noted that they had difficulty with the subsequent pull-ups and did fewer than they usually could do. Some players vomited during or after the workout (Note: Athletes vomit during and after tough workouts but the Committee's impression was that more athletes vomited related to this specific workout than related to other tough workouts.) Some players had difficulty getting from the weight room to the indoor training "Bubble." One player, who was in the 6:00 AM group, noted that he had discolored urine that same evening, but he did not report it to trainers.

Jan. 21 (Fri) – The second day of intensive workouts focused on upper-body muscle groups. A number of players noticed unusual pain and stiffness in their legs after Thursday's workout. The strength and conditioning coaches removed the "hangs," a lift that requires considerable lower-body work, from the Friday workout because they recognized that the players had not performed as well as they were expected to during the previous day's squat exercise. Most of the players completed the Friday workout without substantial difficulty because it worked the major upper-body muscle groups. Many players noted severe leg pain, and difficulty climbing stairs, putting on shoes and socks, and other basic activities.

Five of the affected players noted that their urine was discolored but they did not report this observation to trainers. In addition, 28 players, including 2 of the affected players, had random drug testing that morning; the urine from the 2 affected players was reported to be brown.

Jan. 22 (Sat) – There were no workouts on Saturday. A number of players continued to experience substantial pain and stiffness in their legs, and several reported that they tried to alleviate these symptoms through stretching, massage, or cold-water plunges. Three more players noted dark urine, but none reported this observation to staff of the football program. Some affected players told teammates, friends, or parents that their urine was abnormally dark.

Jan. 23 (Sun) – There were no workouts on Sunday. Numerous players still had serious leg pain and swelling, and one more player noted discolored urine. Of note, most affected players thought they were dehydrated and had been drinking copious amounts of water and sports drinks to rehydrate.

Jan. 24 (Mon) – A speed workout was held on the Monday. Many players reported that their legs hurt so much they could not jump over low hurdles that were usually easy for them. Three more players noted dark urine. The first player reported to a trainer in the early morning and was found to have high blood pressure. He was scheduled to see a primary care sports medicine physician that afternoon. After examining the player and obtaining laboratory tests, the physician diagnosed the player with exertional rhabdo. The physician saw one other player for similar symptoms that afternoon and also diagnosed rhabdo in that player. He began intravenous fluids on both players. Another player was in the Sports Medicine Clinic for a preoperative visit. He spoke with the two players who had been diagnosed with rhabdo and said that he had similar symptoms. The primary care physician again diagnosed with exertional rhabdo and arranged for all three players to be admitted to the UIHC. Shortly thereafter, two more players were identified as having rhabdo and were hospitalized. In the early evening, a text message was sent out to the entire team describing the rhabdo symptoms and urging players to go to the hospital if they were experiencing any of them.

Jan. 25 (Tues) – One more player was hospitalized until a total of 13 were receiving treatment for rhabdo. While in the hospital, all players were evaluated daily by an orthopedic surgeon who is a sports medicine physician. He assessed all of the hospitalized players for compartment syndrome and found no evidence that any of the players had this serious complication of rhabdo.

Jan. 25-30 – Players were gradually released from the hospital as their symptoms disappeared.

Jan. 31 – The last player was released from the hospital.

THE COMMITTEE'S INVESTIGATION

Literature review

The Committee performed an in-depth review of the available medical/scientific literature on rhabdo. Numerous reports of exertional rhabdo were found involving individual persons, such as weight lifters, body builders, and long distance runners engaged in strenuous exercise regimens. Clusters of rhabdo, like the cluster among UI football players, have been relatively rare, but several have occurred recently. The medical/scientific literature suggested to the Committee that there are several factors that may increase either the risk of exertional rhabdo or complications of rhabdo (e.g., anabolic steroids, supplements like creatine, certain prescription and over-the-counter medications such as non-steroidal anti-inflammatory drugs [NSAIDs; ibuprophen, etc.], illegal drugs, alcohol). Dehydration, viral infections, poor nutritional status, poor physical training status, and certain inherited or genetic conditions (e.g., muscle diseases, sickle cell trait) can increase the risk of exertional rhabdo as well. The Committee addressed these possible causal/risk factors in our investigation of why 13 UI football players acquired rhabdo.

Consults with experts on rhabdo

Members of the Committee with medical and scientific training talked with experts around the country familiar with rhabdo, both to gain a better understanding of the medical condition and to obtain ideas about potential underlying causes of the cluster at UI. These experts included medical doctors and exercise physiologists in academic and military settings, as well as persons in the strength and conditioning community. These discussions reinforced what was learned from the literature search and identified some promising leads about factors to assess in interviews with planners, organizers, supervisors, and participants in the workouts between January 20 and January 24, 2011.

Interactions with experts on strength and conditioning

The Committee contacted the two major national associations for strength and conditioning coaches in the US, the National Strength and Conditioning Association (NSCA) and the Collegiate Strength and Conditioning Coaches Association (CSCCa). According to an official at one of these associations, workouts like the implicated workout are common at football programs across NCAA Division I, Division II, and Division III schools. Moreover, the Committee learned that one of these groups has had a large number of phone calls from coaches and administrators wanting to know what happened at UI because of health and safety concerns at their institutions.

Furthermore, the Committee learned that there is considerable tension between the NSCA and the CSCCa and between academicians who do research on strength training and coaches who design and supervise strength and conditioning programs. These tensions and political factions and the small size of the football strength and conditioning community prevented the Committee from obtaining unbiased opinions about what happened at UI. For example, Committee members spoke with two strength and conditioning coaches who work for

professional football teams, neither of whom was willing to offer an opinion. In addition, high-ranking staff members at the two national associations had diametrically opposed views about the risk of rhabdo after a workout of this type.

Responses from parents and guardians

After receiving the student athletes' permission, the Committee sent letters to the parents or guardians of every member of the football team, inviting them to write to us or call us to share any information, concerns, or perceptions they had that might be useful to the investigation. We received 17 responses from parents or guardians. The parents and guardians responding to our inquiry overwhelmingly expressed concern for the short- and long-term health of the affected athletes. The parents appreciated the work of the Committee and indicated that they wanted the Committee to communicate the findings and recommendations directly to them. Parents criticized the UI Football Program for lack of communication (see the section on communication). The parents cited examples of learning about the hospitalizations from the media and rare contact with coaches (too little too late). They interpreted the fact that the head coach did not return immediately to campus as a lack of concern on his part for the affected players and their families. They also commented on the need for more regular communication from the Football Program and for early and frequent communication during critical events such as the cluster of rhabdo. Most parents still support the UI Football Program and the coaches, specifically mentioning that they are grateful for the education provided to their sons on proper nutrition and hydration and the work coaches did to help their sons develop as athletes and as people. However, some parents expressed anger and distrust as a result of this event and suggested that some of the coaches should have been suspended until the investigation was complete.

Moreover, some parents and players felt that Athletic Department staff, the UIHC physician who spoke during the press conference, and at least one former player publically blamed the affected players for having rhabdo and assumed that the players must have done something wrong because 13 of them were affected. Parents also stated that the Football Program must modify its practices to prevent a recurrence. Most parents were troubled that all members of the team were not tested for rhabdo. Parents also stated that the Athletic Department should provide counseling services for the injured athletes to address the emotional and social issues unique to these athletes.

Interviews with staff of the Athletic Department and the Football Program

Members of the Committee personally interviewed every member of the Athletic Department who was directly or indirectly involved in the workouts that led to the hospitalizations. These interviews included the Athletic Director, the Head Football Coach, the Director of Football Operations, the Head Strength and Conditioning Coach, all the other strength and conditioning coaches, the Head Football Trainer, and other athletic training staff members present at the workouts in question. All staff cooperated with the Committee and provided the Committee with the information it requested.

The interviews produced a much clearer picture of what the workouts involved, how they were organized, and the level of supervision provided by the strength coaches and athletic trainers. In particular, interviews with the strength and conditioning coaching staff revealed that they were very organized and had developed a detailed 21-week program to prepare the players so that their strength and conditioning would peak during the football season. These coaches developed specific plans for each athlete, tailoring the plan to each player's needs, strengths, weaknesses, and past injuries or surgeries. Interviews with the strength and conditioning coaches also revealed that their intent for the workout was to put the team through a tough challenge that would strengthen their individual confidence and their confidence as a team. On the basis of an article published in The Journal of Strength and Conditioning Research, the strength coaches felt that the squat protocol employed on January 20, 2011 might increase the players' testosterone and cortisol levels, leading to some muscle hypertrophy. In addition, because they normally workout at about 80% of their maximum weight to maximize muscle hypertrophy, the coaches felt that they could safely increase the number of repetitions (volume) if they decreased the load to 50% of the maximum weight squatted.

During the interviews, we learned that the strength and conditioning coaches were very aware of heat injury and dehydration but they did not know about exertional rhabdo until the cluster occurred. The head trainer had seen one case of exertional rhabdo in the 1980s and the director of the Sports Medicine Program had not seen a case of exertional rhabdo in over 20 years of practice, although he had seen rhabdo cases related to crush injuries. (Note: One of the Committee members contacted a colleague who played in the National Football League before he went to medical school. He subsequently became an orthopedic surgeon and a team physician for a local football team. Like the director of the Sports Medicine Program, he knew about exertional rhabdo but had never seen a case in over 30 years of practice.)

Interviews with players

During the week of February 21, 2011 members of the Committee conducted personal interviews with each of the 13 team members who were hospitalized, addressing similar questions to every player. The players all cooperated fully with the Committee. The Committee sought to obtain a detailed account of the players' practices and experiences from the end of the Insight Bowl to the three days of heavy workouts and also to learn about their experiences in the hospital. The Committee also conducted personal interviews with a few team members who participated in the workouts but did not develop rhabdo, to determine if there were obvious differences between the 13 players who acquired rhabdo and the players who did not. The information gleaned from these interviews helped Committee members develop the anonymous survey and to identify areas to investigate further. Most of the pertinent findings from the interviews are included elsewhere in this report.

Through the interview process, the Committee identified one area about the conduct of the workout at 6:00 AM January 20, 2011 on which players and coaches differed. Several players commented that they were allowed to rack the bar (put it back on its stand) but they were not allowed to take their hands off the bar. These players indicated that this impeded their access to water. One of the Committee members questioned each of the strength coaches and the

student strength coaches separately. Each of them stated unequivocally that the players were able to rack the bar, to remove their hands from the bar, to walk away from the bar, and to drink water. The head strength coach stated that the players have been required to keep their hands on the bar for prior workouts but that was not the case on this occasion. The Committee was not able to determine whether the students confused prior work outs with the workout on January 20, 2011. The Committee was not able to determine which description of the requirements was correct. However, working out at 6:00 AM was not associated with a higher risk of rhabdo than working out at 8:00 AM or 4:00 PM.

Anonymous survey

After the Committee's first working meeting on February 9, 2011, the epidemiologist member of the committee began preparing a detailed survey instrument that every current member of the football team would be asked to complete. The purpose of the survey was to identify differences between the players who became ill after the workouts and those that did not. The Committee, other epidemiologists, and a renal (kidney) physician reviewed drafts of the epidemiological survey, as did several seniors on the 2010 football team who were not involved in the January workouts because they had completed their eligibility. On March 2, 2011 the survey was given to the Associate Director of Athletics, who regularly works with student athletes. He distributed the survey to current members of the football team, collected the completed surveys (maintaining players' anonymity), and gave them to the Committee for data entry, data validation, and analysis. The response to the survey was rapid and enthusiastic. Nearly all surveys were returned and ready for data entry by March 7, 2011. In total, 79 surveys were returned, 13 of which were from players who were hospitalized with rhabdo. One survey was completed by an athlete who did not do any of the workouts on January 20, 21, or 24 because he had recently undergone an operation. That player's survey was not included in the analyses. In addition to this survey, the Committee analyzed data from the workout cards and the player database to try to identify risk factors for rhabdo.

Analysis of Survey Data

Athletes who had rhabdo were significantly more likely that those who did not have rhabdo to report having the following signs or symptoms: **extremely** sore muscles, leg cramping or locking, difficulty putting on their shoes, difficulty bending their knees, swollen muscles, and muscles that were painful to touch. These findings are consistent with a diagnosis of rhabdo. Players with rhabdo were more likely than players without rhabdo to use antiinflammatory agents like NSAIDs after the workouts, to use these agents for more days, to "contrast" (expose muscles alternately to hot and cold water), to take cold baths, to take cold showers, to put ice on their muscles, and to use creams or ointments like Icy Hot© or BENGAY©. In addition, the players who had rhabdo were less likely than the other players to report that they did their usual activities over the weekend. (Note: Only 1 of 13 [8%] players with rhabdo reported going to a party over the weekend compared with 15 [23%] of those who did not get rhabdo. This difference was not statistically significant.) The Committee thinks these factors were not risk factors for acquiring rhabdo among the 13 players but indicate that the players with rhabdo had significant distress and were searching for relief. The Committee has not investigated whether there was an association between the use of NSAIDs and the level of renal dysfunction

because the Committee had access to the medical records from only 7 of the 13 hospitalized players.

Players who had rhabdo were more likely than unaffected athletes to report that they went to muscle failure during the squat workout and that they did not think they could complete the squat workout. Players who had rhabdo were more likely than those who did not have rhabdo to report doing extra squats during the squat workout because some squats were not counted as full or complete squats. The extra squats may have been a risk factor for rhabdo, but the Committee thinks this occurrence was more likely an indicator that the players' muscles were failing and damaged already; thus, the players were unable to complete some squats because their muscles were too fatigued.

Players who did not acquire rhabdo were significantly **MORE LIKELY** to report that they drank protein shakes after the workouts and that they drank protein shakes on more of the days after the workouts than were players who acquired rhabdo. However, using protein supplements during the winter break was not associated with a decreased risk of rhabdo. An alternative explanation for this observation could be that the players who had rhabdo felt too sick to drink protein shakes. The Committee plans to evaluate this possibility further by talking with the affected players after they return from spring break.

The following variables were **NOT** statistically different between the athletes who acquired rhabdo and those who did not: age, race/ethnicity, the number of semesters in the UI Football Program, the workout session on January 20, 2011 (6:00 AM, 8:00 AM, 4:00 PM), the number of meals consumed before the workout, the amount of hydration with water or sports drinks during and after the workouts, the frequency of exercise over the 3-week break, the intensity of exercise over the 3-week break, the time between their last squat workout and the January 20, 2011 workout, trying to beat other athletes' times, running to Hillcrest Dorm and back on Friday morning because they missed training table breakfast, and partying over the weekend after the Thursday workout. In addition, use of over-the-counter drugs, prescription drugs, illegal drugs (no players reported using these agents and drug tests support these reports), energy drinks, pre-workout drinks, supplements (creatine, carnitine), licorice, or alcohol were not associated with acquiring rhabdo. Furthermore, prior illnesses, injuries, or operations were equally common among players who had rhabdo and players who did not.

Evaluation of data provided by the Football Program

In addition, the data from the Football Program indicate that the risk of rhabdo was significantly increased in accordance with increases in the length of time needed to complete the 100 squats and the number of sets needed to accomplish the task. For skilled (e.g., defensive backs, wide receivers) and semi-skilled players (e.g., linebackers, fullbacks), the risk of rhabdo was significantly increased as the percent of body weight lifted increased. However, such a relationship was not found for linemen. These associations persisted when all three of these variables were considered jointly.

Brief online survey of former football players

Two brief online surveys were created and members of the 2004 and 2007 football squads, who underwent similar intense workout experiences, were asked to complete one or both of these surveys (some did both workouts). The goal of these surveys was to assess whether some players may have had rhabdo after the intense workout but did not report their symptoms to medical personnel. Nine former players responded to the survey about the 2004 workout (conducted in early June 2004) and 14 responded to the survey about the 2007 workout (conducted in early December 2007).

None of the players who completed these surveys remembered having brown or very dark urine after the workouts but one of nine players who did the training session in 2004 and one of 14 players who did the workout in 2007 have subsequently passed brown urine after an intense exercise session. Of the players who completed the surveys, about a third of the players (33% in 2004 and 36% in 2007) remembered that they had very sore muscles after the workout and difficulty climbing stairs and putting on socks and shoes (33% in 2004 and 29% in 2007). Fifteen players who completed the survey of current players had done the similar workout in 2007; none of these players acquired rhabdo after either workout. Fourteen of these players answered the question comparing the workout in 2007 with that in 2011; three felt the workouts were about the same, four felt the workout in 2007 was harder, and seven felt the workout in 2011 was harder.

Medical record review

After obtaining medical releases from 7 of the 13 hospitalized players, the physician member of the Committee reviewed the UIHC medical records covering their hospitalizations. Careful histories obtained by the primary-care sports medicine physician did not uncover any legal or illegal practices common to the affected players, including the factors noted earlier in this report that are thought to increase the risk of rhabdo.

Random drug test results review

The physician member of the Committee also reviewed the results of a random drug test conducted on Friday, January 22, 2011 on 28 members of the football team, including 2 players who developed rhabdo. All samples were negative for masking agents, for anabolic agents, amphetamines, barbiturates, benzodiazepines, cocaine metabolites, marijuana metabolites, opiates, phencyclidine, and propoxyphene.

Summary of findings about causal factors

The results of the survey, the data from the Football Program, the medical record review, and the review of the random drug test results indicate that the 13 affected players did not acquire rhabdo because they engaged in risky behaviors. In fact, the results of these studies refute the rampant speculation that the 13 players all must have brought the rhabdo on themselves by using supplements, or using illegal drugs, or partying too much. Rather the results of the Committee's investigation indicate that the number of sets required to complete the workout, the time required to complete the workout, and the percent body weight lifted (for skill and semi-skill players) were the strongest risk factors. Although illness and injury (and, thus, gross

deconditioning) were not risk factors for most of the 13 players, they may have increased the risk for two linemen for whom the percent body weight lifted was not a factor.

EVALUATION OF COMMUNICATIONS SURROUNDING THE EVENT

Positive aspects of communication

As the Committee proceeded through the investigation, its members discovered that the strength coaches, trainers, and other coaching staff have developed substantial, well-structured programs designed to instruct the players on improving their strength, conditioning, position skills, nutrition, hydration, and overall health. The Committee's interviews with the 13 players who developed rhabdo as well as interviews with a number of players who were not hospitalized revealed young men who were well-disciplined with regards to their diets and maintaining hydration. Committee members repeatedly heard how the players were coached constantly on the healthy diets and on adequate hydration needed for strenuous workouts and for playing football. The level of instruction on these topics on the front end of the training for the players appears to be effective.

The Committee learned that, in general, the strength and conditioning coaches, trainers, and team physicians communicate well with regards to the physical condition of the players. This close communication has allowed the training staff to identify players who need medical or surgical evaluations and care and has also allowed them to reintegrate injured or ill players back into training, practices, and games safely by providing appropriate rehabilitation and appropriate modifications. Similarly, this communication system has allowed the strength and conditioning coaches to develop specific programs for individual players to help them address specific injuries, muscle imbalances, and compensations. However, this communication system seems to have failed for one to three of the affected players (see section on areas needing improvement).

Another positive aspect of communication was the text blast that was sent early on the evening of January 24, 2011. This mode of communication allowed the training staff to reach essentially all the football players quickly. Eight of the affected players sought medical care after the text blast and most of them said that they would not have done so if the text message had not been sent. Thus, the text blast enabled staff of the Football Program to identify all the athletes with substantial levels of myoglobin in their urine.

Aspects of communication needing significant improvement

The Committee learned that team physicians often clear athletes by saying they may return "as tolerated." The training staff stated that the athletes will tell the training staff or the coaching staff when they cannot tolerate specific aspects of training and competition. In general, when the training staff and the players know the specifics of the strength and conditioning or training program at the time when players are cleared, this approach may work. However, the Committee questions how free the players are to tell coaches they cannot do something, given that the players are all competing for positions and playing time. In the setting of an unusual, particularly strenuous workout, this method of clearing players after orthopedic injuries or after

illnesses was not effective and may have been confounded by the fact that the workout was the first one performed after a long break. In particular, the strength coaches did not know that one of the players had been hospitalized for an infection over the winter break. Also, the coaches did not seem to recognize that two players who were recovering from orthopedic injuries might have had lower limb muscle deconditioning that would likely limit their ability to perform squat exercises at the level prescribed for the workout January 20, 2011. This is not to say that the strength coaches did not consider the players' recent injuries when they created the workout cards for these two players. They did indeed consider their injuries. In fact, they decreased the weight one of these players lifted because his injury was to a bone in his lower leg. They did not feel that the program for the other player needed to be changed because his injury involved his foot and the squats did not require him to move his feet while lifting weight. If the team physicians had known that the players in question were going back to the extremely rigorous workout of January 20, 2011 and they had stated specifically what the players could or could not do, the outcome for these three players might have been different. Of note, the strength coaches' modifications for other players with injuries or known limitations appear to have been effective in preventing these players from getting rhabdo. Although it did not reach statistical significance, none of the players who did modified squat workouts on January 20, 2011 acquired rhabdo.

Football is a sport that requires physical strength, power, and endurance as well as pride and bravado. The Committee understands the culture of the sport and the extreme toughness and dedication of the young men who play it. The Committee also realizes that the coaches must both instruct the players and also continually push them so that each player performs at his highest level. With that said, the Committee thinks communication between the strength coaches, trainers, team physicians (as described in the previous paragraph), and the players must improve. The coaches must observe the players and talk with the players during and after strenuous workouts and practices specifically to determine if players have unexpected difficulty with the workout or practice or unusual soreness or pain afterwards. The Committee realizes that part of preparing players for the intensity of the games is to push them further than they think they can go, which leads coaches and trainers to respond to players' complaints or statements that they cannot do something with statements such as "everyone is sore . . . buck it up . . . stop feeling sorry for yourself . . . . You just need to get yourself together. " Again, in the usual circumstance these responses might suffice. However, in the circumstance when numerous players who usually perform at a high level have difficulty with the workout or when players report that they can hardly walk, have prolonged and extreme muscle soreness and swelling following the workout, and cannot do their usual activities, the coaches and trainers must go beyond their usual assumptions and ask themselves and the players what other factors could account for the players' poor performance and/or their prolonged pain. Indeed, the strength coaches did recognize that some of the most athletic players did not perform nearly as well as they were expected to perform during the implicated workout. In response, the coaches removed the lower extremity exercises from the Friday (January 21) workout. However, they did not appear to take the next step and ask whether the players had suffered unintended consequences related to the workout. This may be, in part, because they had done similar workouts in the past and had not identified any adverse effects and because, unlike the

workout in 2004, the workout in 2011 was not intended to push the lower extremity muscles to failure. Nevertheless, the coaching staff must now begin asking those hard questions and find ways to distinguish the usual moaning and groaning of players pushed to excel from signs of real distress.

Overall summary of findings on communication

The Committee discovered during its investigation that a major area of concern revolves around communication – within the UI Football Program and externally. The Committee found many aspects of communication that were positive and were done well. However, some aspects of communication need swift and definitive improvement, which in some cases will require the UI Athletic Department and the Football Program to develop new, comprehensive communication approaches for both internal and external constituents, especially players' parents.

THE COMMITTEE'S CONCLUSIONS ABOUT THE RHABDO OUTBREAK

The Committee bases its conclusions about the Rhabdo cluster on a thorough investigation that included an in-depth examination of the scientific/medical literature, interviews and consultations with rhabdo experts, communications with players' parents and guardians, interviews with Athletics Department staff directly involved in the workouts held January 20-24, 2011, and interviews with the 13 affected players, and some unaffected players. The Committee also conducted an anonymous survey of the entire football team, analyzed data produced by this survey and specific data provided by the Football Program, conducted an online survey of a sample of former players, and the doctor member of the Committee reviewed the medical records of affected players and the results of a random drug test performed on January 21, 2011.

A. On the basis of this investigation, The Committee is as certain as possible under the circumstances that the strenuous squat lifting workout the players did on January 20, 2011 caused rhabdo in the 13 who were hospitalized, as well as serious muscle injuries to players who did not develop advanced rhabdo symptoms. We identified some factors that increased the risk of acquiring rhabdo among players who did the squat workout—the number of sets required to complete the 100 squats, the time required to complete the 100 squats, and lifting a high percent of ones' body weight for skill and semi-skill players--and one factor that may have decreased the risk—drinking protein shakes. The Committee did not find a risk factor other than the squat workout itself that was common to all of the affected players.

B. The 13 football players who were hospitalized were in no way responsible for their own injuries. They simply acquired a serious medical condition that can develop after a single session of intense eccentric exercise concentrated on a limited number of skeletal muscle groups, when the stress on the targeted muscles damages muscle tissue to the point that

myoglobin and/or enzymes (e.g., CK) leak from the muscles. The athletes clearly did nothing wrong. In particular, they did not take banned substances or engage in other risky behaviors.

C.Rhabdo was also not associated with use of prescription medications, over-the-counter medications, supplements, or energy drinks in the 13 affected players. As noted above, the investigation did not identify a single, common contributing factor. All players on the team may have been more susceptible because they had just been on their winter break, although a lack of preparation (the amount of exercise performed over the break), nutrition, or hydration were not associated with rhabdo based on survey results.

D. The percent body weight that skill and semi-skill players were squatting was associated with rhabdo. Thus, some of the best squat lifters (i.e., those lifting the highest percent of their body weight) on the team were affected. Players who drank protein shakes during the week of the workouts might have been protected from rhabdo. This observation needs to be followed up by further studies. If it is confirmed, protein shakes could be recommended to athletes undertaking rigorous training and competitions to help prevent this syndrome.

E. Unusually heavy workouts of the type done on January 20, 2011 had been conducted successfully by this coaching staff in June 2004 and December 2007 and were not known to cause rhabdo. Therefore, based on their past experience, the football coaches, strength coaches or athletic trainers did not have reasons to suspect that a similar workout in 2011 would cause exertional rhabdo in 13 players and the temporary incapacitation of many other players with significant leg pain and stiffness.

However, the timing of the workout in 2011 was different than those in 2004 and 2007. The workout in 2004 occurred in June during the start of summer workouts and the workout in 2007 occurred in December after a break of only one week. The Committee hypothesizes that the three-week break between the Insight Bowl in December 2010 and the beginning of the winter workouts might have been a significant issue. The results of the survey indicated that the amount of exercise during the break did not differ for affected and unaffected players, suggesting that at a gross level the affected players conditioning had not decreased significantly. However, many of the affected players were skill or semi-skill players who would likely have more fast-twitch muscle fibers than do lineman. Fast-twitch muscle fibers deplete their fuel or energy stores more quickly than do slow-twitch fibers and, thus, they could fatigue and become damaged faster than slow-twitch fibers. Fast-twitch fibers also decondition quickly at a molecular level (e.g., enzyme composition, neural inputs, energy stores) if they are not stimulated through high-intensity contractions. Thus, the Committee speculates that many of the affected players had deconditioning of these fast-twitch fibers, which might not have been noticeable to the players or coaches, but which might have been significant enough to allow these players to experience severe muscle damage during the workout.

F. So far as we could determine, members of the football coaching staff and the strength coaches had not had prior experience with exertional rhabdo. One of the athletic trainers had seen one case of exertional rhabdo at another university. While this lack of experience did not

cause the rhabdo, it may help explain why the staff apparently assumed the players were experiencing no more than the expected soreness after a tough workout and did not question whether the players had experienced muscle damage.

G. The Committee did not identify any person or group of persons who were negligent or reckless when they planned, conducted, or supervised the strenuous workouts that resulted in 13 players acquiring rhabdo. The Committee concludes that everyone involved in these workouts proceeded in the good faith belief that they could be conducted without harm to the players, just as they had on at least two prior occasions. The Committee is certain that no one intended the serious muscle injuries suffered by the hospitalized players. Unforeseen developments do occur without the fault of anyone involved, and the Committee concludes that is the most accurate characterization of what happened in this instance. Furthermore, as noted above, the Committee did not identify illegal or irresponsible behavior on the part of the 13 players that explains why they were affected and other players were not. The injured players were simply not responsible for the rhabdo symptoms they experienced.

H. The Committee did not find evidence to support the speculation circulated by the media and by the public that the strenuous winter workouts were intended to "punish" the football players for their lack of success during the prior season, or that the players were threatened with harsh treatment, if they did not excel in the workouts. At the first team meeting on January 18, 2011, the strength coach did make comments to the effect that last season's close losses should concern everyone in the Football Program, including the players, that the workouts ahead would be very challenging, and that they would determine "Who wants to be here." Most of the players interviewed by the Committee did not regard these statements as personal disparagements or threats of retribution, but rather as customary motivational "coach speak" that is common to football and to which they were accustomed. A few players, however, did perceive the workout to be punitive, and a number of the players commented that the coaches and trainers downplayed their complaints, saying "everyone is sore."

I. The Committee's investigation revealed that the players received appropriate medical care from the medical specialists responsible for their treatment. The absence of the Director of the Sports Medicine Program when the problem was first recognized did not impair the care of the affected athletes.

THE COMMITTEE'S RECOMMENDATIONS

A. The UI Football Program should reaffirm its decision of January 25, 2011 to no longer use the intense, high-volume squat workout and to design another and safer method to promote the team unity this workout was intended to inspire.

B. Everyone associated with strength coaching and athletic training at UI should be thoroughly educated about rhabdo, its causes and its symptoms, and engage in best practices for preventing it. They should, in turn, teach the athletes about exertional rhabdo and how to recognize this condition.

C. Athletic trainers and strength coaches should develop a mechanism for determining whether players are having unexpected problems with a specific workout or are suffering unexpected complications of a workout.

D. Whenever a few members of a team become ill after a strenuous workout and some are hospitalized or suffer serious muscle injuries, all members of that team should be tested to make sure that, although they do not have the most pronounced symptoms or signs of the ailment, they do not suffer from the same condition.

E. The Athletic Department should provide counseling with a professional sports psychologist for players who acquired rhabdo or who acquire other serious illnesses or injuries associated with their sports.

F. The UI should address any long-term health needs of the affected athletes related to this event, including the possible need for professional counseling to meet psychological or social concerns.

G. Strength and conditioning coaches should provide physicians and athletic trainers who are responsible for clearing ill or injured players with details about the type and degree of exertion required in the workouts/competitions for which they are asked to provide clearance. In addition, physicians and athletic trainers should specify to coaches the activities athletes should not do, and they should not rely on the players to tell coaches or athletic trainers when they cannot tolerate an activity.

H. The Committee's findings and recommendations should be sent directly to all athletes and to their parents with a letter from the President expressing both concern and regret for this unforeseeable event and reassurance that the recommendations from this Committee will be considered seriously and evaluated immediately for implementation.

I. The findings of the investigation, particularly of the football team survey and the other quantitative aspects of the investigation, should be presented at national meetings for coaches, trainers, and sports medicine personnel so that they can learn from this experience.

J. Given their extensive travel, their close contact with other athletes, and the demands of their sports, athletes may be at higher risk than other students for adverse events. The Athletics Department, in general, and all sports programs, including football, must develop and implement an emergency management program that includes a robust emergency communication component. The emergency management plan would allow the UI to: (1) notify parents immediately if an adverse situation (e.g., illnesses, injuries, accidents) has arisen among athletes and (2) communicate with all players on the affected team immediately about a developing situation. The Committee suggests that the Athletics Department work with experts within the UI and the UIHC who have considerable expertise in developing, implementing, and testing emergency communication plans. A coordinated, well-rehearsed emergency management plan, similar to what exists on the health campus and the larger university, could serve as a template for a program specific to the Athletics Department.

Respectfully submitted, March 21, 2011 by
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EXECUTIVE SUMMARY OF THE REPORT OF THE SPECIAL PRESIDENTIAL COMMITTEE TO INVESTIGATE THE JANUARY HOSPITALIZATION OF IOWA FOOTBALL PLAYERS

BACKGROUND

The five-person faculty-staff Committee appointed by President Mason on February 4, 2011 conducted a thorough investigation of the incident involving the hospitalization of 13 Iowa football players diagnosed as suffering from rhabdomyolysis (hereinafter rhabdo). Our investigation proceeded on the basic premise that assuring the safety, health and welfare of student athletes competing on behalf of the University of Iowa is a primary concern of the University and its Athletics Department. All staff of the Athletics Department and the Football Program, as well as the football players themselves, cooperated fully with the Committee throughout its investigation.

Steps in this investigation included reviewing the medical/scientific literature on rhabdo, consulting with external experts on strength conditioning, with the players' consent, inviting perceptions and comments from their parents or guardians, and interviewing persons in the Athletics Department directly involved in the incident, and gathering specific data about the workout suspected of causing the harm. In addition, Committee members interviewed the 13 hospitalized players and other team members, anonymously surveyed all members of the football team about the incident, analyzed data from the player surveys that were returned (94% return rate) as well as data collected from the strength program and from a sample of former players, and reviewed injured players' medical records, while at all times adhering to FERPA and HIPAA privacy requirements. On the basis of its investigation, the Committee reached a series of key conclusions, as summarized below.

CONCLUSIONS

1) Off-season conditioning and strength training are year-round activities in Division I football, and they are essential to achieve success at the Big Ten level of competition.
2) Rhabdo and similar medical conditions are an ever-present, but under-recognized, risk whenever strenuous strength training programs are undertaken.
3) The strength training program at Iowa is nationally recognized for increasing athlete's strength safely, and for promoting healthy hydration and diet.
4) Nevertheless, the squat lifting exercise on Thursday, January 20th seriously injured players' muscles resulting in the rhabdo symptoms in the 13 players hospitalized, and in the unusual stiffness and soreness reported by 67% of the players surveyed.
5) The Committee cannot determine with absolute certainty why this particular squat lifting exercise caused the degree of muscle injury it did, when similar workouts in prior years had not done so. Most likely, however, the combination of a three-week layoff from supervised workouts, the percent of their body weight lifted by certain players, and the high number of repetitions required in this workout were primarily responsible for most of the rhabdo cases.

6) Contrary to unfounded speculation, the injured players were completely blameless in this incident. Medical tests confirmed that no injured player had taken any legal or illegal substances that contributed to their injury. The players had avoided risky behaviors and maintained good conditioning over the three- week break before supervised training was resumed.
7) No football coach, strength coach, athletic trainer, or team physician knowingly did anything wrong, and no one in the Athletics Department performed specific duties negligently or irresponsibly in respect to the workouts that caused the injuries, or during the aftermath of the injuries.
8) As this incident unfolded, communications with the injured players, their teammates, their parents or guardians, the university community and the public were not handled well. This unfortunate incident provides an opportunity to find ways to improve these communications, and for the Athletics Department to develop a comprehensive plan for handling future emergency situations.

The Committee also formulated 10 Recommendations. The six most important are as follows.

RECOMENDATIONS

1) The football program should reaffirm its recent decision to abandon the intense, high- volume squat lifting workout of the type conducted on January 20, 2011.
2) Everyone associated with the football program should be thoroughly educated about rhabdo and similar medical conditions that can result from overly strenuous training.
3) The football program should develop effective mechanisms for determining when players are experiencing unexpected complications or problems from a specific type of workout.
4) Whenever a few members of a team become injured or ill after a strenuous workout, all members of the team should be tested to make sure they are not suffering from the same conditions.
5) The U of I should address the possible long-term health needs of athletes affected by this incident, including the possible need for counseling to address psychological and social concerns.
6) Because student athletes are at a higher risk for adverse events, the Athletics Department should develop an emergency management plan for dealing with incidents like the January 20, 2011 rhabdo cluster.