

A Regular Meeting of the Durham County Board of Health, held June 19, 2014 with the following members present:

James Miller, DVM; Bergen Watterson, MSCP, BA; Mary Ann Fuchs, DNP, RN, NEA-BC, FAAN; Heidi Carter, MSPH; Stephen Dedrick, R.Ph, MS; Dale Stewart, OD; and John Daniel, Jr., MD.

Excused Absence: Teme Levbarg, MSW, PhD; F. Vincent Allison, DDS; and Commissioner Brenda Howerton.

Others present: Gayle Harris, Eric Ireland, Becky Freeman, Rosalyn McClain, Dr. James Harris, Dr. Arlene Sena, Dr. Miriam McIntosh, Chris Salter, Melissa Downey-Piper, Melissa Martin, Eric Nickens, Attorney Bryan Wardell, Michele Easterling, Will Sutton, Pat Gentry, Patrick Eaton, Kenya Chavis-Gomez, Erika Samoff and Councilman Don Moffitt.

**CALL TO ORDER:** Chairman Jim Miller called the meeting to order at 5:07pm with a quorum present.

**DISCUSSION (AND APPROVAL) OF ADJUSTMENTS TO**

**AGENDA:** Ms. Harris requested the following revision to the agenda.

1. Budget Update (old business)

Ms. Carter made a motion to accept the addition/adjustment to the agenda. Mr. Dedrick seconded the motion and the motion was approved unanimously.

**REVIEW OF MINUTES FROM PRIOR**

**MEETING/ADJUSTMENTS/APPROVAL:** Dr. Fuchs made a motion to approve the minutes for May 8, 2014 meeting. Ms. Carter seconded the motion and the motion was unanimously approved.

**PUBLIC COMMENTS:** There were no public comments.

**STAFF/PROGRAM RECOGNITION:**

Ms. Harris stated that Mel Downey-Piper and David Reese, President and CEO of East Durham Children's Initiative will travel with her to Aspen, Colorado to accept the Robert Wood Johnson Foundation Culture of Health Prize on Wednesday, June 25, 2014. The morning following the announcement of the winning counties, there will be interviews with local media through satellite broadcasting and telephone.

**ADMINISTRATIVE REPORTS/PRESENTATIONS:**

- **PUBLIC HEALTH PREPAREDNESS PLAN AND RESPONSE (OPERATIONS/ROLES) (Activity 7.4 and 36.3)**

Ms. Patricia Gentry, public health preparedness coordinator provided the Board with an overview of the Durham County Emergency Operations Plan. Ms. Gentry's presentation objectives were: review situational events requiring response from DCoDPH Preparedness and the associated response plans; identify partners; and advise Board of Health members of their roles and opportunities to become actively involved in case of an actual event. PHP partners with state and local agencies to prepare for and respond to emergencies and events that may affect the citizens of Durham County. The DCoDPH **E**mergency **O**perations **P**lan is written in accordance with the Durham County **EOP** and activated when a public health emergency exceeds standard operating procedures. Plans require specific communications to take place between the Health Director, the County Manager, and Board of Health before certain assets can be requested. Training and practice are ongoing requirements. Opportunities to volunteer are realized by developing and maintaining/educating the Medical Reserve Corps (MRC). Plans and needs are reviewed and updated regularly in an effort to identify weaknesses and areas needing

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improvement. Communications with partners is ongoing and plans are exercised in accordance with state and federal guidance or recommendations.

Ms. Gentry provided the Board a Preparedness Response folder with helpful information.

Ms. Harris stated that all staff members are scheduled to work in 12-hour shifts in case of an actual emergency. The staff assignments are in schedules for the Emergency Operation Center, nurses, and miscellaneous duties. The schedules are updated when positions are added or deleted and when there are staff changes.

*(A copy of the PowerPoint presentation is attached to the minutes).*

- **PUBLIC HEALTH VACANCY REPORT** *(Activity 37.6)*

The Board received a copy of the May 2014 vacancy report which included information on the vacant positions from July 1 through May 31, a total of 41.0 FTEs *(5 new positions, 6 resignations, 3 transfers, 5 dismissals, 6 promotions, 3 demotions, 1 grant ended and 12 retirements)*. *(A copy of the May 2014 vacancy report is attached to the minutes)*

- **NOTICES OF VIOLATIONS (NOV) REPORT** *(Activity 18.2)*

The Board received a copy of the Environmental Health Onsite Water Protection Section NOV report for May 2014. The report documented notices of violations issued to property owners who are noncompliant with the “Laws and Rules for Sewage Treatment and Disposal Systems.” *(A copy of the May 2014 NOV report and status update is attached to the minutes)*

**Health Director’s Report  
For May 2014 Activities  
June 19, 2014**

**Division / Program: Administration / Information and Communications**

**Program description**

- The Information and Communications program provides accurate, timely, and relevant information to the residents of Durham County on key health issues as well as informing the public about department programs and services availability. Information is disseminated in many forms, included broadcast, print, and multimedia (web-based).

**Statement of goals**

- To increase the public’s awareness and understanding of important health information and the Department of Public Health’s programs and services availability
- To increase the public’s utilization of the Department of Public Health’s programs and services.
- To become the main, trusted and dependable choice for journalists seeking information and assistance to develop compelling and balanced stories on Public Health issues.

**Issues**

- **Opportunities**
  - With staff dedicated to information and communications, the Department of Public Health can provide more information to the public on health issues
  - Media/reporters are eager to use information provided to them by the Department of Public Health for their viewers/readers.

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Television and radio announcers often request follow-up information and interviews.

- **Challenges**
  - Prioritizing the topics to publicize
  - Staff balancing external media requests with internal needs to review/revise/develop new media to promote programs and services.

**Implication(s)**

- **Outcomes**
  - Information and communication about health issues and department programs and services are being publicized in a timely, organized manner and with greater frequency.
  - Visibility of public health information from the department has substantially increased.
- **Service delivery**
  - During the month of May, four (4) media releases and one (1) media advisory were disseminated. Staff also responded to three (3) direct (unsolicited) inquiries from reporters. A total of 13 media pieces featuring the Department were aired (television), printed in the news, or were posted to the web by local media during the month. These included coverage of activities including our monthly *My Carolina Today* segment, the founder of Triple P speaking in Durham, pool inspections, health inspection reports, water testing at Rolling View Beach in advance of the Memorial Day holiday, and Veggie Van's first birthday celebration. (**Accreditation Activity 5.3- Health Alerts to Media, 9.1- Disseminate Health Issues Data, 9.5- Inform Public of Dept. / Op. Changes, 10.2- Health Promotion –Disease Prevention, 21.2- Make Available Information About LHD Programs, Services, Resources**)
  - Two Communications Team members attended the NC Office of Emergency Management's G291 JIC/JIS Training held May 28-29 in the Durham County Human Services Building. The elements of this training will allow our communications staff to work seamlessly in a county or regional emergency event, should the scale of the event necessitate a public information component. (**Accreditation Activity 6.2-Role in County Emergency Operations Plan, 6.3-Participate in Regional Emergency Preparedness Exercise), 7.6-Testing of Public Health Preparedness Response Plan**)
  - The department Communications Manager, in addition to the Health Education Division Director, and Partnership for a Healthy Durham coordinator, worked with a film crew from Home Front Communications based in Washington, D.C., from May 22-24 to capture footage throughout Durham County and conduct interviews with community leaders. Communications, Health Education, and the Partnership for a Healthy Durham are also feverishly working with staff from Washington, D.C. based Burness Communications on other aspects of another upcoming project. (**Accreditation Activity 5.3- Health Alerts to Media, 9.1- Disseminate Health Issues Data, 9.5- Inform Public of Dept. / Op. Changes, 10.2- Health Promotion –Disease Prevention, 21.2- Make Available Information About LHD Programs, Services, Resources**)

**Next Steps / Mitigation Strategies**

- Continue building/developing various communication channels as well as the Department of Public Health's delivery of information and communications.

**Division / Program: Community Health Division / Tuberculosis Control Program**

**(Accreditation Activity 17.3- Monitor compliance with communicable disease control laws and rules.)**

**Program description**

- Investigate and report all tuberculosis cases in Durham County to state public health
- Provide treatment for clients with Tuberculosis (TB)
- Conduct outreach efforts to rapidly identify individuals who are high priority contacts to a confirmed case of tuberculosis.

**Statement of goals**

- To ensure all persons with active tuberculosis will complete a standard multi-drug regimen and to rapidly identify individuals who are high priority contacts to the confirmed case in order to evaluate risks of exposure.

**Issues**

- **Opportunities**
  - Investigation initiated to identify all contacts to a 10 year old diagnosed with active TB
- **Challenges**
  - Accurately identifying all contacts to a 10 year old in a local school; investigation included identification of all contacts in school (school staff and students), extracurricular activities, family, friends, etc.
  - Mobilizing an adequate number of qualified staff to register and screen contacts, administer TB skin tests (Phase I), and to return 2 days later to interpret/read the results of the skin tests (Phase II)
  - Planning and coordinating on-site (school) TB skin testing and follow-up for the 153 contacts identified (transporting TB testing associated supplies, staff, paperwork, educational materials, etc)
  - Maintaining the confidentiality of the student (Active TB Case) and family members while communicating with students, parents, and school staff sufficient information to decrease alarm or anxiety.

**Implication(s)**

- **Outcomes**
  - Identified three contacts with positive TB skin test results; all referred for a follow-up chest X-ray. TB clinic staff will obtain x-ray results, provide care, and deliver services as indicated.
- **Service delivery**
  - Tested 103 of 124 identified contacts; the additional 21 will be tested by their primary care provider or at the health department.
- **Staffing**
  - For Phase I, eight DCoDPH staff participated, including seven nurses and one administrative staff member. For Phase II, five nurses and one administrative staff member participated. The regional nurse consultant from the state TB Control Program also assisted.

**Next Steps / Mitigation Strategies**

- Continue treatment of the active case.
- Begin treatment for latent TB of family members--all tested and are asymptomatic.

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- Test all contacts again at 8 weeks per CDC recommendations (scheduled for early July).
  - Maintain communication with school, students, families, and others to answer questions, provide information as needed, and ensure follow-up is provided as needed.
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**Division / Program: Community Health Division / Parenting Program-Triple P Event**

**(Accreditation Activity 12.3-Participate in a collaborative process to implement population-based programs to address community health problems.)**

**Program description**

- Dr. Matt Sanders, professor of clinical psychology, University of Queensland, Australia, and the founder of the evidence-based Triple P Positive Parenting Program, visited Durham on May 5, 2014 and presented a free training entitled, “Triple P, 0-12 Years Seminar -The Power of Positive Parenting,” for parents with children between birth and 12 years of age.

**Statement of goals**

- To provide an overview of the Triple P-Positive Parenting Program.
- To provide an awareness and understanding of the clinical and practical benefits of Triple P.

**Issues**

- **Opportunities**
  - Provide a forum to introduce this evidence-based, population-based approach to parenting to the community.
  - Identify risk factors associated with the development of social and behavioral concerns in children.
  - Identify skills necessary for parents to become self sufficient in managing family issues without ongoing support.
  - Describe strategies for families to develop positive relationships, attitudes and conduct.
- **Challenges**
  - The Triple P Coordinator for Durham County is in the process of developing and implementing the community outreach plan to provide education and training to approximately twenty (20) child service agencies and providers.

**Implication(s)**

- **Outcomes**
  - Promotes the independence and health of families through the enhancement of parents’ knowledge, skills, confidence and self-sufficiency.
  - Promotes the development, growth, health and social competence of young children.
  - Promotes the development of non-violent, protective and nurturing environments for children.
  - Reduces the incidence of child maltreatment and behavioral/emotional problems in childhood.
- **Service delivery**
  - Triple P-Durham County will work closely in collaboration with Triple P America, the North Carolina Triple P Learning Collaborative and community partners to implement this population based parenting program in Durham County.

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- **Staffing**

- The DCoDPH Triple P Program Coordinator collaborated with the NC Triple P Learning Collaborative and Triple P America to plan this event.

**Next Steps / Mitigation Strategies**

- Offer interventions from different levels of Triple P to ensure a range of intensities is available to accommodate all parents' needs. A range of different delivery types (one-on-one, seminars, groups and online) will be considered in order to support the individual preferences of the parent community and practitioner base.
- Train a range of practitioners who have regular interactions with parents. These could include family workers, social workers, psychologists, doctors, nurses, school counselors, mental health providers, teachers and clergy.

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**Division / Program: Community Health / Family Planning – On-site Mammography Screening**

**(Accreditation Activity 20.1-Collaborate with community health care providers to provide personal and preventive health services.)**

**Program description**

- The Family Planning Clinic provides contraceptive services to women of child-bearing age.
- Some of those women are 40 years old or older and should begin receiving screening mammograms.

**Statement of goals**

- To provide screening mammograms to women who are uninsured.
- To make access to this screen as convenient as possible in order to encourage participation.

**Issues**

- **Opportunities**

- Rex UNC Health Care operates a mobile mammography screening bus. Services are free to women who qualify financially.
- Rex accepts invitations from local businesses, community organizations, and health departments to provide this service.
- Rex Mobile Mammography had an open date on May 1, 2014.

- **Challenges**

- Amy Alspaugh, Certified Nurse Midwife in Family Planning Clinic, contacted Rex Mobile Mammography to find out all the requirements.
- A service agreement was signed between Public Health and Rex Mobile Mammography.
- Eligible women (many of whom had been placed on a waiting list for up to 9 months) were contacted and asked to come in before May 1 to fill out the necessary paperwork to make the day of the visit go more smoothly.
- Parking space was reserved in Durham County Human Services parking lot for the bus.

**Implication(s)**

- **Outcomes**

- Nineteen women received screening mammograms on May 1.
- The process was efficient and professional.

- **Service delivery**

- Services in the Family Planning Clinic were not disrupted.

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- The women receiving mammograms were very positive about their experiences.
- **Staffing**
  - Interpreter Ilka Pabilo assisted with Spanish interpretation to decrease waiting time for Spanish-speaking patients. No other Public Health staff was utilized.
- **Revenue**
  - This program was revenue neutral.

**Next Steps / Mitigation Strategies**

- Rex UNC Health Care agrees to follow up on any abnormal results and to link the women with these abnormal results to any necessary resources for diagnosis and treatment.
- More visits from the Rex Mobile Mammography bus will be planned.

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**Division / Program: Nutrition / DINE for LIFE / Nutrition Education in Durham Schools**

**(Accreditation Activity 10.2 -Develop, implement and evaluate health promotion/disease prevention programs and educational materials targeted to groups identified as at-risk in the CHA.)**

**Program description**

- DINE for LIFE is a school- and community-based nutrition education program targeting SNAP-eligible Durham families.
- The school-based program is taught in 12 Durham elementary schools: Eastway, E.K. Powe, Fayetteville St., Forest View, Glenn, Holt, Lakewood, Merrick-Moore, R.N. Harris, Southwest, W.G. Pearson and Y.E. Smith.

**Statement of goals**

- To increase the nutrition knowledge of Durham elementary school students.
- To encourage simple behavior changes towards healthier eating habits and lifestyles.
- To promote wellness within the school community and advocate for environmental changes in the schools that support wellness.

**Issues**

- **Opportunities**
  - The DPS Wellness Policy states students will be given age-appropriate nutrition education in the classroom. The DINE school-based curriculum satisfies the schools' Health and Wellness standard of Nutrition Education for grades K-5 with no added teaching burden to the classroom teachers.
  - Each school is expected to form a Wellness Committee that will create and support a healthy environment where students can consume nutritious meals, snacks and beverages; get regular physical activity; and learn about the importance of lifelong healthy behaviors. DINE nutritionists are members of the Wellness committee at the schools they serve.
- **Challenges**
  - Although there is a core curriculum standard for nutrition education to be taught to all grades, schools are not held accountable for teaching it to the students. Schools are evaluated on the students' performance on reading and mathematics only. Therefore, classroom time allotted for nutrition education is sometimes marginalized or no time is provided for instruction due to the pressure of improving student reading and mathematics scores.

**Implication(s)**

• **Outcomes**

- During the 2013-2014 school year, 144 classrooms (grades K-5) in 12 schools received the DINE curriculum.
- Approximately 2750 unduplicated students received 8 hours of sequential nutrition instruction through the DINE curriculum.
- Parent surveys were distributed to participating students to gather feedback from their families and assess potential behavior changes occurring at home. 790 parents filled out a survey about the DINE program.
  - 83% of parents indicated that after having nutrition classes their child is more aware of healthy meals and snacks.
  - 78% of parents indicated that after having nutrition classes their child is more willing to eat healthy foods (vegetables, fruits, whole grains, etc.).
- Positive feedback was received from parents about changes they have noticed in their child's behavior. Comments included:
  - *[Nutrition classes] have made our student much more interested in and aware of food choices, and she often talks about what she has learned.*
  - *It has made our student more willing to try new foods.*
  - *My child is so eager to share what he learned!*
- Teacher surveys were also administered to assess changes occurring in the classroom and gather suggestions from school staff. Eighty-five teachers filled out a survey about the DINE program.
  - 81% of teachers indicated that since receiving nutrition lessons, at least some of their students bring healthier meals or snacks from home.
  - 79% indicated that since receiving nutrition lessons, at least some of their students have increased their consumption of vegetables.
  - 90% indicated that since receiving nutrition lessons, at least some of their students are more willing to try new foods.
  - 74% of teachers rated the nutrition program as a whole as "excellent".
- Teachers expressed positive feedback on how the nutrition lessons integrated into the academic curriculum:
  - *[The smoothie class] integrated well with our fraction and measurement lessons.*
  - *The handouts and slides had good math and science connections. They learned a lot of new words, as well.*
  - *Students and I have multiplied the nutrition labels to determine how many calories they are actually consuming in one sitting.*
- Teachers also commented on positive behavior changes in their classrooms:
  - *Students have been bringing in much more healthier snacks. I have also noticed that they chose white milk instead of chocolate milk. They have also increased their conversations among themselves about eating healthy at home. I even heard a student telling another student how important it is to try different foods in the cafeteria. I have seen a big change in their eating. Thanks so much!*
  - *My students will try different fruits and vegetables first before saying they don't like it.*
  - *Please continue the great work you are doing! Most of the students have learned about healthy eating for the first time with these classes and might not have otherwise!*

- **Service delivery**
  - The 8-lesson DINE curriculum is based on the 2010 Dietary Guidelines. Each lesson included instruction, hands-on activities, and a taste test. Students are sent home with parent handouts that reinforce key nutrition messages, recipes, and educational incentives (such as rulers, pencils and jump ropes). Additionally, students are given specific, simple healthy eating “challenges” to apply what they learn.
  - In a few of the schools the program includes cooking lessons and incorporation of the school’s garden: E.K. Powe, Forest View, Holt and Lakewood.
  - Nutrition lessons are taught in each participating classroom approximately every 3 weeks throughout the school year (from October to April).
  - Topics include MyPlate, food safety, whole grains, dairy, fruits and vegetables, protein, breakfast and healthy snacks.
- **Staffing**
  - Nutrition education is provided by five DINE nutritionists, who are Registered Dietitians.
- **Revenue**
  - No revenue is generated through this educational program; activities are supported by the SNAP Ed Nutrition Education and Obesity Prevention Program grant.

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**Division / Program: Nutrition Division / Increasing Access to Healthy Foods**

**(Accreditation Activity 12.2 - Participate in a collaborative process to assess resources needed, including personnel, funding, policy changes, and system change, to address community health problems.)**

**Program description**

- A large partnership of community organizations is working to increase access to healthy foods for Durham residents.
- Both the Durham Farmers’ Market and South Durham Farmers’ Market started accepting SNAP Electronic Benefits Transfer (EBT) cards (food stamps) in April.
- Both markets will also implement the Double Bucks program to expand the EBT benefits at the markets.

**Statement of goals**

- To increase access to healthy, local food for low-income Durham residents.

**Issues**

- **Opportunities**
  - This project has allowed for the partnership of many non-traditional health partners, including the farmers markets, Triangle Transit Authority (TTA), Durham Congregations, Associations, and Neighborhoods (CAN), NC Office on Disability and Health, Transition Durham, Rural Advancement Foundation International-USA, Farmer Foodshare, and many others.
  - Unlike many nonprofit organizations that are working to increase food security, the farmers markets are for-profit businesses that are sustainable and do not rely on grant funding.
  - The Community Transformation Grant (CTG), Healthy Communities funding and DCoDPH’s SNAP Ed grant provides funding for marketing efforts and supplies. A Facebook ad campaign and DATA bus ad campaign were recently launched, and a radio ad campaign with Radio One is planned for the

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summer. DCoDPH also purchased wooden tokens for the program.

- **Challenges**
  - Both markets are working to raise enough funds to make Double Bucks a sustainable program.
  - Much work is needed to increase awareness of the programs and change shopping habits so that SNAP participants think of the farmers' markets as a place to grocery shop.

**Implication(s)**

- **Outcomes**
  - The South Durham Farmers' Market has started a Double Bucks program. The Durham Farmers' Market aims to start Double Bucks in July/August. Double Bucks allows customers using SNAP benefits at the market to double their benefits up to \$10 each time they shop. The program is funded through grants and donations.
  - The TTA has agreed to move the Durham Connector bus stop onto market grounds during market hours for 6 weeks to see if ridership increases. Currently it stops about three blocks away and customers would need to walk up a hill.
- **Staffing**
  - One DCoDPH nutritionist has been providing technical assistance to the markets.
  - The Nutrition Division is actively recruiting for a SNAP Ed funded Healthy Environments Nutritionist position that will help with marketing, promotion, and fundraising for the program throughout Durham County.

**Next Steps / Mitigation Strategies**

- Continue efforts to move the bus stop.
- Continue fundraising efforts.
- Continue marketing efforts.

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**Division / Program: Nutrition and Health Education Divisions / Durham Food Policy Council Formation**

**(Accreditation Activity 12.2 -Participate in a collaborative process to assess resources needed, including personnel, funding, policy changes, and system change, to address community health problems.)**

**Program description**

- Food Policy Councils provide local, regional, or state governments, as well as residents, information and advice about various policies and programs that support community-based food systems. Such a food system emphasizes, strengthens, and makes visible the relationships among producers, processors, distributors, and consumers of food at the local and regional levels. A number of local and regional food policy councils are forming throughout North Carolina.

**Statement of goals**

- To create a viable, thriving local food system in Durham County that is accessible to all residents.

**Issues**

- **Opportunities**
  - There are many organizations, individuals, and entrepreneurs who are working on issues of food access, food justice, and food systems in Durham County. This council will provide guidance, a platform for networking and sharing ideas and

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resources, help strengthen current initiatives and limit duplication of efforts.

- **Challenges**
  - To create a successful council, Durham City, County, and local organizations and citizens must work together. Some of these groups have had difficult relations in the past. Using an outside agency to facilitate the meetings is helping rebuild strained relationships.
  - Durham has many small groups that have seen themselves as a policy council in the past that either disbanded or were not inclusive. These councils were mostly resident and volunteer led and did not have defined structure, as the one that is currently planned. Some stakeholders are hesitant to join in another effort at starting a council.

**Implication(s)**

- **Outcomes**
  - Stakeholders in Durham County have had their first meeting to start forming a food policy council. The meeting was facilitated by NC State's Center for Environmental Farming Systems (CEFS). It was organized in part by DCoDPH Nutrition Department Staff and Community Transformation Grant Project Region 10 staff.
- **Staffing**
  - One DCoDPH nutritionist has been attending meetings and helping to lead this initiative.

**Next Steps / Mitigation Strategies**

- Continue efforts to create a structured, all-inclusive food policy council.
- Write grants for financial support to continue receiving technical assistance and meeting facilitation by CEFS (\$10,000 will buy one year's services including website design).

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**Division / Program: Nutrition Division /Clinical Nutrition/Collaboration with Lincoln Community Health Center (Accreditation Activity 12.2 -Participate in a collaborative process to assess resources needed, including personnel, funding, policy changes, and system change, to address community health problems.)**

**Program description**

- Durham's Department of Public Health provides nutrition assessment and counseling to clients of Lincoln Community Health Center (LCHC). The DCoDPH Nutrition Clinic is the primary source of nutrition support services for LCHC clients.

**Statement of goals**

- To make Medical Nutrition Therapy (MNT) and Diabetes Self Management Training (DSMT) available to all LCHC clients.
- To continue collaborative efforts between DCoDPH and LCHC to address community health issues.

**Issues**

- **Opportunities**
  - In November 2011, LCHC no longer had funds to support nutrition therapy and counseling on-site for LCHC clients. At that time, the DCoDPH Nutrition Clinic began receiving the referrals from LCHC for all clients needing nutrition services.

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- **Challenges**

- Lack of a shared electronic medical record system between LCHC and DCoDPH has made communication regarding the referrals and client assessments cumbersome.
- Of the referrals received, 31% result in an actual client visit to the Nutrition Clinic due to difficulty in contacting clients (telephone numbers and addresses changing) and a 39% “no show” rate for appointments.

**Implication(s)**

- **Outcomes**

- Currently, clients in need of nutrition counseling are referred from all clinics at LCHC to the DCoDPH Nutrition Clinic. These nutrition referrals include clients from the Early Intervention Clinic, the Adult and Pediatric Medical Clinics, as well as WIC and LATCH programs.
- Medical Nutrition Therapy is conducted with clients for a wide range of diagnoses including diabetes, overweight or obesity, gestational diabetes, inappropriate weight gain or weight loss, and chronic medical conditions such as cancer, HIV, hypertension.
- The number of referrals received from LCHC to DCoDPH has increased from an average of 7 per month in 2011 to an average of 150 per month currently.
- Approximately 46 new clients and 40 follow-up clients from LCHC are seen each month in the Nutrition Clinic for medical nutrition therapy.
- Approximately 3 new clients from LCHC begin the Diabetes Self Management Training program each month.

- **Service delivery**

- Staff at both DCoDPH’s Nutrition Clinic and LCHC are working together to ensure the best provision of service to the clients.
- 90% of LCHC nutrition referrals are for clients with a diagnosis of diabetes or pre-diabetes. DCoDPH Nutrition Clinic is able to offer both MNT and DSMT to clients living with diabetes.

- **Staffing**

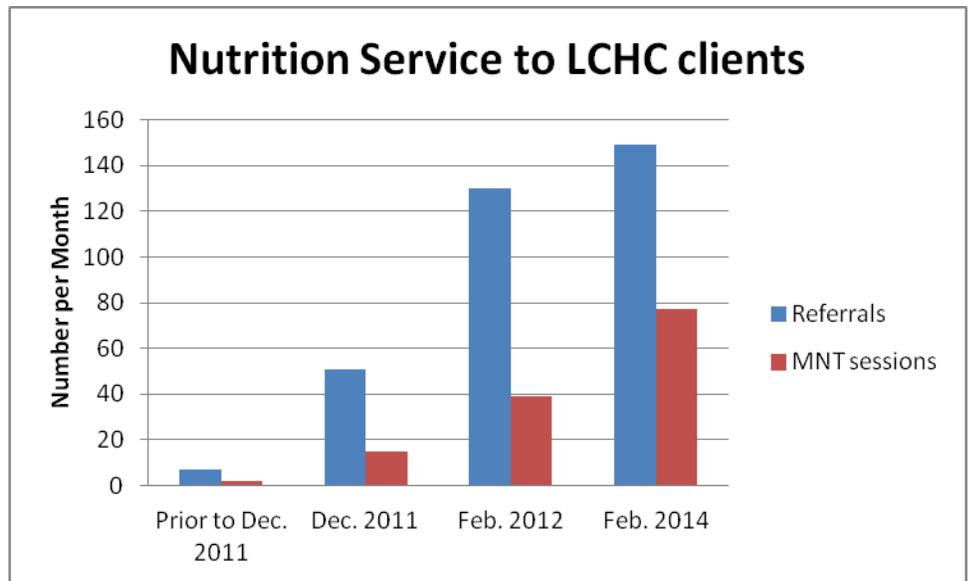
- The DCoDPH Nutrition Clinic is staffed with Registered Dietitians Monday through Friday from 8:30am- 5:00pm and on Tuesday until 7:00pm. A processing assistant is also in the clinic during these hours.
- 45% of LCHC clients seen in the DCoDPH Nutrition Clinic are Spanish speakers. The Nutrition Clinic has a Spanish speaking RD on staff. Interpreters are also available to interpret for nutrition counseling visits.

- **Revenue**

- Clinical nutritionists are credentialed providers for billable MNT services.
- Fees for MNT and DSMT are based on a sliding fee scale. Medicaid and third party reimbursement sources are billed when applicable.

**Next Steps / Mitigation Strategies**

- Continue to collaborate with LCHC to provide nutrition services.
- Continue working together to enable the necessary exchange of information in the most efficient manner possible with the hope that a shared electronic medical record will be an option in the future.



**Division / Program: Dental Division / Access to Dental Care for Uninsured Adults**

**(Accreditation Activity 20.1 -Collaborate with community health care providers to provide personal and preventative health services.)**

**Program description**

- As of January, 2014, the Dental Division has resumed collaboration with Project Access Durham to offer dental screenings to uninsured adults in need of care. A volunteer dentist completes screenings at the Department of Public Health. Based upon the screening results, Project Access then makes a referral to a local dentist that has agreed to treat patients at no cost. This program is part of the clinic’s regular schedule – now operating two Friday afternoons per month, with six patients screened each session.

**Statement of goals**

- To increase access to dental care to adult populations in Durham County.
- To work collaboratively with community partners to highlight the need for oral health services for uninsured patients.

**Issues**

- **Opportunities**
  - Offering dental screening to adults who may not otherwise receive treatment due to being uninsured.
  - Sharing information about additional services available at the Department with adults being screened.
- **Challenges**
  - Having to limit the amount of patients screened to six (6) per session.
  - Entry into the program is through Project Access only. (The clinic is repeatedly asked about this service by other adults).

**Implication(s)**

- **Outcomes**
  - 38 adults have received dental screening in Dental Clinic from late January through May.
  - The most frequent dental needs are extractions, partials, and dentures.
- **Service delivery**
  - The dental screening provided includes a panoramic x-ray and individual treatment plan.

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- **Staffing**
  - Dr. Ted Brooks, former dentist with the Department, performs the screenings on a volunteer basis.
  - The Dental Division provides two dental assistants for the project to take x-rays, chart notes, and print out the treatment plan.
- **Revenue**
  - The Department provides the screenings free of charge.
- **Other**
  - Participating dentists in the community who accept referrals for dental treatment after screenings include Dr. Desiree Palmer, Dr. Steadman Willis, and Dr. Grant Service.

**Next Steps / Mitigation Strategies**

- Conduct a few screening clinics over the summer months and resume a regular schedule in September.

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**Division / Program: Environmental Health/Onsite Wastewater & Water Protection**

**(Accreditation Activity 17.1: The local health department shall conduct inspection and permitting activities for state mandated environmental health regulatory program.)**

**Program description:**

- The local health department shall issue an authorization for wastewater system construction authorizing work to proceed and the installation or repair of a wastewater system when it has determined after a field investigation that the system can be installed and operated in compliance with the rules and regulations adopted under Article 11 of Chapter 130A of The General Statutes of North Carolina. Wastewater can be rendered ecologically safe and the public health protected if methods of wastewater collection, treatment and disposal are properly regulated. Recognizing that wastewater collection, treatment and disposal will continue to be necessary to meet the needs of an expanding population, the General Assembly intends to ensure the regulation of wastewater collection, treatment and disposal systems so that these systems may continue to be used, where appropriate, without jeopardizing the public health.

**Statement of goals:**

- In response to a request from the Durham County Manager's Office, the Onsite Water Protection Section (OSWP) conducted a field survey of existing onsite wastewater (septic) systems in the proposed service area of the Rougemont Community Water System.
- The goal of the survey was to ascertain the type, location, and functional status of onsite wastewater systems within the proposed water service area.

**Issues:**

- **Opportunities**
  - Using the list of parcels provided by the County Manager's Office and tax records letters were mailed to property owners on January 22, 2014 notifying them of the impending survey.
  - Letters were sent to each of the parcels in the proposed service area. For those owners with mailing addresses different from the parcel to be visited, a copy of the letter was also sent to their alternate address.
  - Site visits began on January 27 and concluded February 4, 2014.

- **Challenges**

- During each site visit, the EHS located all above ground system components such as tank risers, pump control panels, and manifold/valve boxes. For conventional gravity systems, tile probes were utilized to assess the location of the buried tanks and drain lines. The identified septic system areas were traversed for any signs of surfacing effluent to indicate malfunction.

**Implication(s)**

- **Outcomes**

- Rule 15A NCAC 18A .1961(a) (1) describes the criteria to classify a septic system as failing. Owners must maintain their system to prevent the following 3 conditions:
  1. a discharge of sewage or effluent to the surface of the ground, surface waters, or directly into the groundwater at any time; or
  2. a back-up of sewage or effluent into the facility, building drains, collection system, or freeboard volume of the tanks; or
  3. a free liquid surface within three inches of finished grade over the nitrification trench for two or more observations made not less than 24 hours apart. Observations shall be made 24 hours after a rainfall event.

- If a system meets one or more of these conditions, then it is considered malfunctioning by the .1900 rules. For the purpose of this survey, condition 1 was the only criteria that could be easily observed. Without access to homes or repeat visits, conditions 2 and 3 cannot be verified. Both team members must agree that a system is malfunctioning for it to be deemed as such.

- Survey Results:

Number of Parcels Selected for Survey

**81**

Number of Parcels EHS Denied Entry by Owner

**5**

Undeveloped/Uninhabitable Parcels (no system)

**32**

Total # of Onsite Systems

**49**

NC DWR Systems (sand filters) Identified

**0**

Systems with Ponding or Surfacing Effluent

**5**

Overall Failure Rate

**10.2%**

Systems with identified repair area

**28.6%**

Systems with moderate to severe repair limitations

**71.43%**

- **Service delivery**

- Site plans with the location of septic system components are available for 26 systems with permits on file with Environmental Health. No components could be verified on 5 parcels with active systems due to the depth of the system. The remainder of the systems visited were sketched by EH staff during the visit. Should the community water system be installed, it is recommended that Environmental Health be contacted to locate the systems on site prior to service line and meter installation.

- **Staffing**
  - A team of two Environmental Health Specialists visited each property in the proposed service area and reported their findings.
- **Revenue**
  - No revenue for the program will be gained from this activity

#### **Next Steps / Mitigation Strategies**

- Although only 5 of the systems evaluated during the course of our survey exhibited signs of failure, the majority (77.8%) of systems within the survey area exceed the mean service life expectancy for septic systems in Durham County. While many factors affect the overall performance and longevity of septic systems, the rate of failure is certain to increase with time due to the advanced age of most of the systems in the survey area.
- A site and soil evaluation must be performed in accordance with the State rules to determine if a repair may be permitted. Soil characteristics, soil depth, available space, topography, landscape position, and soil wetness must all be considered when designing a repair option. If any of these conditions cannot be satisfied, or the system cannot be repaired in such a way that the EHS has no reasonable expectation for the system to function, then no repair permits can be issued. It is important to be aware that no individual parcel can be permitted or denied a permit without a complete evaluation. That being said, considering available space and soil series, we estimate that >71% of the parcels within the survey area have moderate to severe limitations regarding septic system repair.

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#### **Division / Program: Health Education / Communicable Diseases and Maternal Child Health**

#### **(Accreditation Activity 10.3 - The local health department shall employ evidence-based health promotions/disease prevention strategies, when such evidence exists.)**

##### **Program description**

- [\*Touchpoints\*](#) is an evidence-based theory of child development based on the work of [Dr. T. Berry Brazelton](#) that is used by providers across disciplines. Once implemented by providers, this method helps parents understand regressions that accompany their children's developmental spurts, which occur often during the first years of life. The Touchpoints approach gives providers tools to support parents during these challenging times and to strengthen the parent-child relationship.

##### **Statement of goals**

- To strengthen parent –child relationship during predictable regressions during a child's development.
- To support relationships (parent-child, parent-provider, provider-child)
- To establish a new way to understand child development through the process of development
- To create a common language that will ensure Durham providers are effectively connecting with parents during critical developmental regression periods.

##### **Issues**

- **Opportunities**
  - The Touchpoints Collaborative has strengthened the health department's relationship with local agencies including the

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Durham's Partnership for Children, Department of Social Services, Durham Public Schools, Child Care Services Association, and Durham Early Head Start.

- The Collaborative will train 100 Durham-based providers over a two-year period to utilize Touchpoints approach with families.
- Touchpoints will help break down silos by building relationships among providers across disciplines to create a more unified community.
- Durham agencies and the Durham County Department of Public Health have adopted another evidence-based intervention.
- **Staffing**
  - Ms. Parks-Bryant, DCoDPH health educator, was selected among a competitive pool of applicants to become a Touchpoints trainer. Following a local training, she was part of a 5-member Durham team that completed the Community Level training in Boston from March 16<sup>th</sup> – 21<sup>st</sup>, 2014.
  - Ms. Parks-Bryant noted that due to the team-work approach the health department has focused on for the past two-years, she was well equipped to perform and excel during the week-long training.

**Next Steps/Mitigation Strategies**

- The 5-member Durham team facilitated a Touchpoints training for providers in May and 30 individuals attended. The team is currently working to plan another training in September 2014.

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**Division / Program: Health Education Division/Men's Health Advisory Committee**

**(Accreditation Activity 19.2 - The local health department shall take actions to include linguistically and culturally representative persons in planning and implementing programs intended to reach underserved population groups.)**

**Program description**

- Men often report poorer health than women across a broad range of indicators; however, male participation in health promotion programs is often less than 25% of participants. To address this, on March 27, 2014, the Health Promotion and Wellness Program initiated a men's health advisory committee (currently called "Committed and Caring Men: A Health Advisory Committee"). This group is engaging men from communities with the greatest health disparities.

**Statement of goals**

- Start and maintain a conversation about the health of men in Durham County.
- Identify culturally acceptable and effective approaches for engaging African American and Latino men in health promotion activities.
- Train a cadre of capable men to lead evidenced-based health promotion activities.
- Create a forum where mature men can share their life stories with younger men and boys to make healthy lifestyles more socially acceptable.

**Issues**

- **Opportunities**
  - A diverse group of African American and Latino men accepted the invitation to join the committee. These men are respected

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and trusted members of their communities. Communities represented include: Business, West End Durham, City and County Government, Elected Officials, Ministerial Alliance, Faith-based Congregations, Art, University, Health Care, Housing Authority, Operation Breakthrough, Head Start Program.

- Men are more likely to participate in programs lead by men. As a result, this initiative aims to identify and recruit capable men to serve as role models and leaders in health promotion activities.

- **Challenges**

- Identifying trusted and capable men to lead health promotion activities.
- Overcoming cultural barriers that prevent men from participating in disease prevention and disease management activities.
- Identifying health promotion activities and settings that appeal to men both culturally and socially.

**Implication(s)**

- **Outcomes**

- Eighteen trusted and respected male leaders from the Durham community agreed to serve on this advisory committee.
- Two meetings of the committee have been held. During these meetings, men identified several life events that had the greatest influence on them and could be effective methods for engaging other men.
- Committee members agreed to: develop a common message explaining their purpose, network with each other to create a bond, bring younger men to meetings, and identify male-specific approaches.

- **Service delivery**

- Initiative is in the second month of implementation.
- During this crucial time members are developing a plan of action.

- **Staffing**

- Two Health Education staff members (one male) serve as meeting organizers and facilitators. The Health Promotion and Wellness Manager is an advisor.

- **Revenue**

- Durham Diabetes Coalition grant funds for community involvement and outreach were used to support meeting costs.

**Next Steps / Mitigation Strategies**

- Define a clear and concise mission statement with no more than two goals that committee members will use as their “elevator speech” to explain their purpose.
- Create a timeline of activities and create an Executive Summary Report by May 2015.

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**Division / Program: Health Education Division/Durham County 2014 Wellness Booster**

**(Accreditation Activity 12.3 - The local health department shall participate in a collaborative process to implement population-based programs to address community health problems.)**

**Program description**

- The Durham County Wellness Team, which consists of County and City Government employees, has planned and implemented the Wellness Booster for the last 11 years. This annual event focuses on physical activity, nutrition and many other health topics.

**Statement of goals**

- Provide opportunities for City and County employees to learn about physical activity, nutrition and connect them to services offered by local health vendors/exhibitors.
- Increase participation in and exposure to a variety of exercise classes.

**Issues**

- **Opportunities**
  - The event is a collaborative effort Durham County and City Government and the YMCA.
  - This year, the Wellness Booster was held in the Durham County Human Services Building to celebrate the end of Public Health's centennial. Vendors and participants liked this change.
  - County and City government employees have the opportunity to participate in "sampler" exercise classes, often exposing them to the newest exercise trends.
  - County employees learned about the procedures for Lunchtime Aerobics and other fitness activities held in the Fitness Center. These opportunities are provided by instructors from Public Health/Health Education Division.
- **Challenges**
  - Some employees and exhibitors confuse the Wellness Booster with organization sponsored employee benefit events. This may impact participation rates as they perceive it as a duplication of events.
  - There was a change in venue, however, anecdotally several clinic staff said this was the first time they were able to attend since the YMCA location took too much time away from patient care.

**Implication(s)**

- **Outcomes**
  - Greater awareness of personal health and health related services offered by the partnering agencies and outside exhibitors.
  - 189 City and County Government employees attended the event, which is an increase over the previous two years.
  - 28 vendors/exhibitors displayed health and/or personal enrichment information and donated almost half of the door prizes given to the participants.
  - This year's Wellness Warrior Challenge had competitors from both the County and City. A total of 10 men and women competed in separate categories. This was a very competitive event planned and led by Public Health's fitness instructor in collaboration with the YMCA's Wellness Director. One winner from each category went home with a trophy. Both winners were city government employees.
- **Service delivery**
  - This free event for Durham County and City Government employees was offered during lunch time in a health fair-type setting with interactive activities.
- **Staffing**
  - Durham County and City and Downtown YMCA employees make up the Durham County Wellness Team.
  - Health Education provided two certified fitness instructor to lead the fitness activities.
  - Durham County General Services Department provided, set up and cleared the tables and chairs.

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- Approximately 30 volunteers from both government organizations and two NCCU students staffed the event.
- **Revenue**
  - The Durham County Manager has consistently supported this employee health event and allocated \$1,200 of funding this year to conduct the event.

**Next Steps / Mitigation Strategies**

- Health Promotion staff will compile the participant and the vendor/exhibitor evaluations.
- The County Wellness Team will hold a wrap up and evaluation breakfast within one month of the event.
- The County Wellness Team will begin planning the 2015 event in September 2014.
- The County Wellness Team will have conversations with city and county employees in regards to this year's location and discuss the pros and cons of Human Services Building and YMCA.

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**Division / Program: Health Education/ Durham Diabetes Coalition (DDC)**

**(Accreditation Activity 10.2 – The local health department shall carry develop, implement and evaluate health promotion/disease prevention programs and educational materials targeted to groups identified as at-risk in the CHA.)**

**Program description**

- In observance of Diabetes Alert Day, the Durham Diabetes Coalition provided 20 health activities/events during the month of March.

**Statement of goals**

- To bring awareness of type 2 diabetes by having community members complete the American Diabetes Association's Diabetes Risk Test.

**Issues**

- **Opportunities**
  - Partnered with the American Diabetes Association and Healing with CAARE, Inc to provide a Saturday event to reach individuals who may be unable to participate in events during the work week.
  - Staff performed various community outreach activities to promote Alert Day activities.
- **Challenges**
  - Severe weather limited the amount of community outreach in targeted communities prior to Alert Day activities and events.
  - Diabetes screenings were not available at each event and were frequently requested by community members.

**Implication(s)**

- **Outcomes**
  - Prior to Diabetes Alert Day, event information, diabetes education and risk tests were provided to a variety of organizations including: the Durham Center for Senior Life, El Centro Hispano, at PAC meetings, and at local churches.
  - On Diabetes Alert Day, March 25, various community organizations partnered with the DDC to provide risk tests, diabetes education, and resources for community members.

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- Diabetes presentations were conducted at El Buen Pastor Church, Holy Cross Catholic Church, and at three (3) Durham Housing Authority sites.
- The diabetes health fair at CAARE, Inc. included: diabetes risk tests, A1c and blood pressure screenings, information on nutrition, physical activity, and diabetes complications. Representatives from American Diabetes Association, CAARE, a Healthier Durham, and the Affordable Care Act were also present.
- **Service delivery**
  - DDC utilized social media (Facebook and Twitter) and its website to promote and provide type 2 diabetes information and update the community on coalition activities.
  - DDC and American Diabetes Association representatives appeared on My Carolina Today television show to promote alert day events.
- **Staffing**
  - The DDC Health Education Specialists and the Information and Communications Specialist led the event planning and staffed the events along with assistance from the DDC clinical team and community partners.

**Next Steps / Mitigation Strategies**

- Neighborhood outreach will continue in targeted neighborhoods.
- A Take 2 for Type 2 campaign will continue to encourage completion of the diabetes risk test.

**COMMITTEE REPORTS:**

There were no committee reports discussed.

**OLD BUSINESS:**

- **2014 National Association of Local Boards of Health (NALBOH) Annual CONFERENCE:**

Mr. Harris reminded the Board that the funds are available in the 2015 budget for three board members to attend the 2014 NALBOH Conference. Interested board members were asked to contact Rosalyn McClain.

- **NEXT STEPS: E-CIGARETTES: (Activity 34.5)**

Ms. Harris stated that Mr. Dedrick sent the federal registry notice about the notification the public comment period regarding the proposed rule: Deeming Tobacco Products To Be Subject to the Federal Food, Drug, and Cosmetic Act, as Amended by the Family Smoking Prevention and Tobacco Control Act; Regulations on the Sale and Distribution of Tobacco Products and Required Warning Statements for Tobacco Products. A link to the document was sent to the Board in a previous e-mail. Ms. Harris asked the Board if they wanted to send a recommendation to the FDA before the July 9<sup>th</sup> deadline. A draft response that will be sent from the NC Association of Local Health Directors was given to the Board for review.

**Questions/Comments:**

**Ms. Carter:** Have we added e-cigarettes to our smoking ordinance?

**Ms. Harris:** We are working toward it based on how they are defined by the FDA. Some health departments and counties have already included vaping with smoking in their local rules.

**Chairman Miller:** Waiting for the FDA ruling makes more sense before we change our rule.

**Ms. Harris:** While we are talking about smoking; Michael Scott, Public Health Educator works hand-in-hand with Environmental Health to enforce the existing smoking rule. We plan to redo the signage, particularly on the sidewalks and have Mr. Scott more visible in the park areas. Ms. Harris stated that the Communications Manager plans to

revitalize the smoking rule information. Mr. Scott will visit the director of Downtown, Durham Inc. to ask if the ambassadors who are picking up litter are available to assist people with directions and distribute information on the smoking rule as they do other tasks.

**Chairman Miller:** What about the tobacco trails?

**Ms. Harris:** Yes, the trails are supposed to be smoke-free.

Ms. Carter made a motion to draft a statement similar to the North Carolina Association of Health Directors supporting the Food and Drug Administration (FDA) in proposing new regulations for electronic cigarettes, hookah, tobacco, cigars and other tobacco products including pipes, nicotine gels, and dissolvables. Dr. Fuchs seconded the motion and motion was unanimously approved.

- **APPLICATION OF SLIDING FEE SCHEDULE:** (*Activity 39.3*)

Ms. Harris stated that when the Title X sliding fee schedule was presented to the Board there was no discussion of how the schedule would be specifically applied to immunizations. Historically, staff did not apply the sliding fee scale to immunization charges. Ms. Harris stated she'd like to develop a policy statement. Ms. Harris stated without the sliding fee schedule the department would charge \$29.00 for flu vaccine when the public could get it for \$25.00 at Wal-mart and people who are uninsured may not get the flu vaccine because the state doesn't always provide free vaccine. The state regulations provide free vaccines for certain populations. The Children's Vaccine Program covers uninsured children at a certain salary threshold, and pregnant women for Tdap.

Eric Ireland called other health departments to see how they handled immunization charges. Mr. Ireland stated that he contacted seven to eight health departments ranging in different sizes and asked the question whether they utilize sliding fee schedules in regard to immunization fees for vaccines. Mr. Ireland received six responses and none of the health departments use a sliding fee schedule for immunization vaccines. Mr. Ireland stated that Orange County was a little different in that they charge the full fee but if the patient can't pay they work with them on a payment plan for vaccines.

Ms. Harris stated, so that we are clear in our policy we need the Board to say whether or not we can slide the charges on the immunizations.

**Questions/Comments:**

**Dr. Stewart:** How does the sliding scale fee work?

**Ms. Harris:** The Title X sliding fee scale was approved to be effective in February. We ask customers to bring proof of income so that we can document it.

**Chairman Miller:** Is there a short list of services that are on the sliding fee schedule?

**Ms. Harris:** The charges for vaccines are the only services that don't use the sliding fee scale. Sexually Transmitted Disease and Tuberculosis services are not charged to the patient but we will bill Medicaid if the patient receives it but that's by state requirement.

**Ms. Carter:** Do you have a recommendation for us?

**Ms. Harris:** In the past when the County Manager has talked about public health clinical fees the Board of County Commissioners have asked "what happens if someone can't pay?" His response was "we will provide the service." If we are appropriately educating people about the expectation for them to pay I would support using the sliding scale fee schedule because we don't want to be a barrier causing people not to get what they need. We do have to make sure that all customers know that they need to bring proof of income when they come for services. In some communities, customers are told without the documentation they will be charged the full amount.

**Chairman Miller:** How big is this in the scheme of things?

**Ms. Harris:** You have to understand that our patient population is only 35% Medicaid so approximately 65% self-pay primarily a low wealth population. In our total budget (\$22 million) our Medicaid revenues are \$1 million.

**Chairman Miller:** That's small in the scheme of things but yet some of the vaccines are more expensive. I like the idea that for those who can't afford it...it makes sense.

**Ms. Harris:** So what about if I get the policy group to draft a policy statement that would apply the sliding fee schedule with proof of income documented by "X period of time" and if at the end of that time we don't get the proof (check stub etc.) then the charge goes to 100%?

**Ms. Bergen:** Is this a requirement that patients know about before they come in or do they get the shot and then they are told a charge?

**Ms. Harris:** No. When they come in, they are income-assessed and informed of the charges based on the sliding fee schedule.

**Ms. Watterson:** If I need to get an immunization today, do I call and make an appointment...does someone tell me to bring a pay stub with me? So that I know ahead of time to bring a paystub?

**Attorney Wardell:** I recommend that we say that you would have to have proof of income before you come in for immunization services and take out the middle part.

**Ms. Harris:** So we need to decide if customers are unemployed what kind of documentation is needed.

**Ms. Carter:** What do they have to show to receive SNAP benefits etc?

**Attorney Wardell:** It's not uncommon if you do means testing for certain things to know what you have to bring so it's not a surprise for anybody.

**Mr. Dedrick:** Do you do any 340B billing?

**Ms. Harris:** We only get 340B pricing for Family Planning, STD and TB because we are not a primary care site. Is the decision for immunizations that have historically been provided at 100% of charges for self-pay customers that we require the proof of income upfront, apply the sliding fee scale accordingly and that we find out how DSS determines eligibility for benefits for those who say they are unemployed?

**Ms. Carter:** How many different guidelines are there on the sliding scale?

**Ms. Harris:** On the Title X fee scale, the percent charged goes from 0-100 percent in 20% increments based on family size. When the number in the family exceeds the maximum number printed on the scale, there are instructions on how to add those family members to determine percentage charged.

**Chairman Miller:** In my assessment, this is the only thing that's not on the sliding scale fee and it makes it more difficult than having it on the sliding scale fee. Having everything the same; it seems like it would also make it easier.

**Ms. Harris:** We will contact DSS to determine methods used to document unemployment and draft a policy and procedure that will address applying the sliding fee scale to vaccine charges.

- **FY 14-15 BUDGET UPDATE: (Activity 39.3)**

Ms. Harris stated that she presented the department's budget highlights based on the County Manager's recommendation to the BOCC on May 29<sup>th</sup>. His recommendation included: most of the department's priority 1 increases; priority 2 (2 positions for Environmental Health and associated costs); priority 9 (0.11FTE Public Health Nurse II in School Health); and priority 10 (0.2FTE Public Health Nurse in Family Planning); Commission Reckhow asked about increasing charges associated with services in the Environmental Health Onsite Water Protection so that the program could be self-sufficient. She asked to see the various pricing for the activities. Chris Salter and Patrick Eaton put together the requested information. They included fees for the surrounding counties for

comparison. All fees were doubled and some new fees related to swimming pools were added. If approved, the changes could generate an additional \$117,410 that would go toward salaries for three staff members. There are six staff members in that cost center but the full costs cannot be recovered. Before the request for the 2 Environmental Health Specialists was approved, the BOCC asked to see workload measures and justification for the request. We provided the BOCC with a 2011 report from a state consultant showing the need for an additional 4.5 FTEs in the General Inspections program. The BOCC did not provide any recommendations regarding the adjusted fees included in the documentation submitted. The budget will be adopted on Monday night, June 23<sup>rd</sup>. Any new fees for Environmental Health would have to be added later as an amendment to the 2015 budget ordinance.

**NEW BUSINESS:**

• **BUDGET RATIFICATIONS:**

The Department of Public Health requested approval to recognize additional Centers of Medicare and Medicaid (CMS) grant funds in the amount of \$32,300 from Duke for use in the Durham Diabetes Coalition (DDC) project program delivery. The funds will be used to purchase materials used in community programs and home visits that support positive diabetes self-management behaviors. Funds will also be used to support continuing education of DDC project staff.

The Department of Public Health requested approval to recognize grant funds in the amount of \$8,000 from Person County Health Department. Funds will also be used to support the Community Transformation Grant Project.

Mr. Dedrick made a motion to approve the budget ratifications in the amount of \$32,300 (CMS grant) and \$8,000 (CTG grant). Dr. Fuchs seconded the motion and the motion was unanimously approved.

• **REPEAL OF SWIMMING POOL RULES:** (*Activity 34.4*)

Patrick Eaton, Supervisor for Environmental Health Onsite Water Protection provided an overview and discussion on the existing Local Swimming Pool Rules.

- The “Regulations Governing Swimming Pools in Durham County” were enacted by the Durham County Board of Health and became effective on January 1, 1994. The intent of this rule set was to enhance safety and protect the public health by correcting for perceived deficiencies in the State regulations (15A NCAC 18A .2500, et seq.)
- During the past twenty years the State rules have undergone multiple amendments, new rule additions, construction standard updates, and inclusion of federal suction hazard reduction requirements resulting in the State regulations that now mirror or surpass our local requirements in many areas. These deficiencies in local standards now render the local rule set unenforceable and create potential liability issues for Durham County.

The differences between the local rules and the current NC Administrative Code (NCAC) are described below with rule citations:

- Section III requirements are addressed in 15A NCAC 18A .2509
- Section IV requirements are addressed in 15A NCAC 18A .2510
  - Section IV(B) mandates that all operation permits expire at the end of the calendar year, however State rule allows year-round operation permits to be valid for 12 months from the date of issuance.
- Section V requirements are addressed in 15A NCAC 18A .2511 except for V(C).

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- Section V(C) requires operators to notify the Health Director of any accident or illness related to the pool within 72 hours. 15 NCAC 18A .2540 requires reporting within 2 working days.
- Section VI requirements are addressed in 15 NCAC 18A .2535 except VI(D).
  - Section VI(D) requires the operator to record disinfectant and pH levels 3 times daily. 15A NCAC 18A .2535(11) requires once daily readings. The Environmental Health Division has no empirical evidence to prove any increase in protection to the public health by requiring the additional readings. Anecdotal evidence from EH staff authorized in pools suggest a substantial number of the second and third additional recordings may be spurious.
- Section VII requirements are addressed in 15A NCAC 18A .2535(10) except VII(A)(3).
  - Section VII(A)(3) is a superfluous requirement for a chlorine test kit that tests up to 10 ppm. This is not addressed in the State rules and operators are mindful of high chlorine levels due to the cost of the product.
- Section VIII requirements are addressed in 15A NCAC 18A .2535 except VIII(J) and (K).
  - Section VIII(J) requires pool closure for the presence of algae. Small amounts of algae along coping or pool wall surfaces is not considered a critical violation and easily removed by cleaning. Clear guidance is given in 15A NCAC 18A .2535 regarding critical water quality violations that result in immediate permit suspension thus rendering Section VIII(K) obsolete.
- Section IX – Fencing requirements are addressed in 15A NCAC 18A .2528, furthermore Section IX(A)(3) is less stringent than the current state requirement.
- Section X requirements are addressed in 15A NCAC 18A .2533
- Section XI requirements are addressed in 15A NCAC 18A .2534
- Section XII requirements are addressed in 15A NCAC 18A .2537 except Section XII(E) which is addressed in 15A NCAC 18A .2522
- Section XIII requirements are addressed in 15A NCAC 18A .2530 except XIII(I) and (L).
  - XIII(I) and (L) - drain cover requirements have been superseded by more stringent State and Federal requirements. 15A NCAC 18A .2518, .2539, and U.S.C. 8001 (et seq.) now regulate pool drains.
- Section XIV requirements are addressed in 15A NCAC 18A .2515(b) and .2528
- Section XV- permit suspension and revocation authority are granted by § 130A-23(d) and described in 15A NCAC 18A .2511

Given the multitude of redundancies and discrepancies in the local rule set, it is the recommendation of the Environmental Health Division that the Board move to repeal the “Regulations Governing Swimming Pools in Durham County.”

***(A copy of the GS 15A NCAC-Section.2500-Public Swimming Pools, Regulations Governing Swimming Pools in Durham County and the Recommendation Letter to repeal the Local Swimming Pool Rules are attached to the minutes)***

Dr. Stewart made the motion that the Local Rules/Regulations Governing Public Swimming Pools in Durham County be repealed and to rely solely upon 15A NCAC 18A .2500 et seq. and the Virginia Graeme-Baker Pool

and Spa Safety Act, 15 U.S.C. 8001 et seq. Ms. Carter seconded the motion and the motion was unanimously approved.

- **DISCUSSION AND RECOMMENDATION: BELL SCHEDULE FOR SCHOOLS:** (*Activity 41.1*)

Based on a request from the last Board meeting, Ms. Harris thanked Eric Ireland for conducting the literature review regarding adolescent sleep habits, school bell schedule and academic achievement. The Board received the documents via e-mail. Ms. Harris asked Ms. Carter to talk a little bit about the current DPS bell schedule and School Board considerations before Mr. Ireland presented summary findings from the literature review.

Ms. Carter stated that she was really impressed with all the links and summaries that were provided to the Board. Ms. Carter stated that Durham Public Schools has a bell schedule right now that fosters sleep deprivation in adolescents. Community members have contacted the School Board asking to consider revising the bell schedule for Durham Public Schools so that the elementary age children who start closer to 9:00am would start earlier and either middle school and high school or just high school, depending on logistics, would start later. Ms. Carter stated this is not necessarily a unanimous interest of the School Board. Normally, people push back against the effect the changes may have on extra curriculum activities in high schools (student participating in sports), jobs and child care for children. The School Board discussed this at the last work-session and asked administration to look at how other districts who have a later bell schedule for adolescents; how they are managing all the potential disruptions and come back to the School Board with a feasibility study, including the challenges and benefits. The School Board also talked about whether they should just flip the schedules or move everybody back thirty minutes; which would be the easier thing to do.

**Questions/Comments:**

**Mr. Dedrick:** What is this Board's role in this decision?

**Ms. Carter:** Well, I asked at the last meeting if the health department might be interested in writing a recommendation to the School Board or something like that...take a position on this. I remember when I served on the Board about ten years ago when we were adopting our Wellness policy we had the health department nutritionist come and speak to us about nutrition recommendations...I thought that maybe something similar could happen. It would depend on how important you feel this issue is as our Public Health Board.

**Ms. Harris:** As Ms. Downey-Piper, Health Education Division Director pointed out last time that data in the Youth Risk Behavior Survey show that our students, particularly African-American students, are reporting significantly less than the recommended amount of sleep each night.

Eric Ireland summarized the literature review using a PowerPoint presentation that provided the following information: Some of the risky health behaviors that we deal with on a daily basis are associated with adolescents and the sleep that they are not getting. Most studies recommend that they should be getting 8.5 to 9 hours of sleep each night. Biologically their sleep patterns begin to change in adolescence. We, as parents, think that they just want to stay up late. Actually, it is because of biological changes in their biological clock they don't begin to feel sleepy. Mr. Ireland stated "It plays a significant role when they have to get up at 6am to get a bus at 7am, to be at school at 7:30 or 8am." There are some solutions that are suggested to be considered (e.g., setting priorities, keeping sleep journals, Not eating or drinking 2 hours before bedtime). A number of studies have been done regarding adolescent sleep patterns and school start times. As a result of the findings, changing school start times is suggested and has been implemented across the country. In 1999,

congressmen in California introduced a congressional resolution to encourage school districts to reconsider early morning school start time to be in more sync with the adolescent biological clock. A study by a Dr. Carla Walsh from the University of Minnesota demonstrated the impact of pushing back school start time. After the Minneapolis school district changed the high school start time from 7:15am to 8:40am, she investigated the impact of the change in the start time for the student performance. She found improvement in attendance and enrollment rates, increased daytime alertness, and a decrease in students reporting depression. Dr. Carlos Catlin found that if you change the school start time and make it later in the morning, students: are less likely to experience depressed moods and less likely to be tardy for school; have reduced absenteeism; and achieve better grades. These changes are because they are able to pay attention to what is going on in the classroom. The research studies also spoke to barriers in delaying school time (e.g., transportation systems and how they are designed to run efficiently—bus schedules, costs, etc). A solution was to switch the high school and elementary school start times and bus schedules so that you are picking up elementary school students a lot earlier and the high school students a lot later. There may be some push back related to this solution because of other results, such as: 1) during the winter months elementary school students would be standing at the bus stops in the dark or waiting at home alone; 2) having limited time to participate in high school afterschool activities especially around school football; 3) reduced access time at community resources such as the public library and other community resources, programs and community centers. Possible push back from some teachers who may say that this would cause them to have less time with their families. Some research found that not to be the case but many teachers are able to spend more time with students and planning before school. Stress on families is another issue you would probably face. An uneducated community is one of the bigger issues. You really need to get out in front of this issue and really discuss the change in the school start time and begin to educate the community about the impact of sleepless nights on adolescents and how that impacts their school work, ability to pay attention, and whether they are alert during the day or they find themselves laying their heads down on the desk taking a nap. The key is educating the community on what the real cause is that is driving the need to change school start times.

**Chairman Miller:** The elementary school time for Durham is...7:30am?

**Mr. Carter:** No, the elementary schools start time is from 8:45 to 9am. The high school is 7:30am and the middle school is 7:30am. Really I don't want to force this on anybody I just wanted to engage interest in having the Board of Health weigh in on this at some point and I'm not even sure now would quite be the appropriate time yet or further down the road.

**Mr. Dedrick:** It's clearly something that we can support but I think that the community engagement is really the key no matter what we do if our community doesn't understand it...because I wasn't aware of a lot of this...I know the kids might make better grades, particularly in high school and in getting ready to go to college, it seems like it makes a whole lot of sense. The other issue would be to get solutions to address the obstacles...The transportation would be huge so whoever is in charge of the transportation solution would need to be ready for whatever that solution is so when that comes up.

**Ms. Carter:** Yes, you're right.

**Dr. Stewart:** Would a half-hour change be impactful? Or would it have to be more than a half-hour?

**Mr. Ireland:** Based on what I have read I think it would need to be more than a half-hour.

**Ms. Carter:** I was wondering about that too, is that too little to make a difference or would ever little bit help.

**Mr. Ireland:** If you could change the high school start time to what the elementary school start time I think that would make a big gesture.

**Chairman Miller:** The next meeting in August would be the Youth Risk Behavior Survey or risky behavior and that would tie in this lack of sleep.

**Erika Samoff:** We can talk about that in August but just to give you a serious number 18% of high school kids got 8-hours or more of sleep a night. So that's not really a lot. The other obstacle is people having to pay more in day care.

**Ms. Carter:** Yes. I hear that a lot. Actually that is really not true because their having to have day care in the morning because their starting so late and a lot of people say I need the older child to be home before the younger child gets home so that that child can babysit.

**Mr. Ireland:** Well, when you think about it, at some point all of us had to make those kinds of decisions and things change for us all the time. We have to be flexible with the things we do in regard to day care. I think overall people will adjust and they will make the necessary changes for the benefit of the child.

**Dr. Fuchs:** But you know if we are just adjusting a half hour without education and understanding why the kids will just say "hey I can stay up a half hour later." I can see that, and so I really do think we need to be approaching them with education that supports any kind of potential change it comes much sooner than a proposed change to try to help them understand the importance.

**Mr. Ireland:** Also one of the other things in the studies found is that students try to make up for not getting enough sleep during the week by sleeping later on the weekend. Their bodies are not able to develop a regular sleep pattern. So the problem continues.

**Mr. Dedrick:** I was reading a publication this week that said the most powerful venue over talking or texting is using charts. The visual part of the brain is bigger than the mental part of the brain so if you put it in chart form and they see it in print it's powerful. The other thing would be to bring in stories. You could bring in family members or teachers that have already done this. Telling their stories could be powerful.

**Dr. Fuchs:** I also think a campaign through social media to the kids would be really important to help them understand.

**Mr. Harris:** Infographics that could be developed to present the story and the research findings or statistics. This is a great way to present messages.

**Mr. Carter:** Really, I do feel like the school system does a really solid job in community engagement, and education campaign. We have tried this before and it really didn't go very far I don't know if it would go better if part of the education was coming from health people instead of our transportation director.

**Ms. Harris:** As we think about how we share the messages from the Youth Risk Behavior Survey that maybe something that we can weave into whatever we are doing.

**Ms. Carter:** That's a great idea. This is great information and I will certainly start to use it. As far as any action by the Board of Health maybe we can wait and see what the Comprehensive Risk Behavior Survey shows us before making a recommendations.

I appreciate you all for thinking about this.

**Chairman Miller:** You may have to give them more time to get there; it may take more time to go to bed and then it may take more time to get up.

**Dr. Fuchs:** Without understanding the impact...that's why education is so important not just to the parents but to the kids. You can impact the kids especially when they are younger to help them understand the importance of healthy behaviors and keep pushing it.

**Ms. Harris:** Even getting some of the science teachers to work with students on sleep journals and making them more personally aware of what their body is saying and starting to have that message that they are not getting enough sleep embedded in the discussions.

**Dr. Fuchs:** Of all the programs that are offered through the department is there an opportunity to interject a piece of information to parents, to children, to whomever we serve in some way about the importance of sleep. Think about any of the programs especially when you are touching parents with young children. I really do believe that is really where you have to start to help them understand the importance of healthy behaviors. Do we offer any of that information and is there a way to provide just a short piece of information. It would be interesting just to see if there is any way you can provide that in a continuing fashion, it would help to build on what is important...not just to keep good grades or exercise but you got to get rest.

**Ms. Harris:** We could do that between our Communications person helping us with crafting a message and then disseminating it by our school nurses and nutritionists that work with the school-age children. We certainly can do that.

*(A copy of the sleep study literature is attached to the minutes)*

**AGENDA ITEMS-AUGUST 2014 MEETING**

- ❖ Youth Risk Behavior Survey (YRBS) Results Teen Pregnancy Prevention-Long-Acting Contraceptives
- ❖ Community Transformation Grant (September-October)

**INFORMAL DISCUSSION/ANNOUNCEMENTS:**

Ms. Harris stated that on July 1, 2014 there will be an all-day retreat led by the County Manager and a facilitator to discuss performance and outcome measures related to the County's strategic plan.

She also reported the department received the cost settlement information from Medicaid. The settlement amount will be 1.4 million dollars. When the funds are received, they will be added to the department revenues.

Ms. Harris introduced Kenya Chavis-Gomez, a student in the Duke School of Nursing Master Program in Administration. Ms. Chavis-Gomez spent about six weeks in the department looking at practice management issues. She also began the analysis of the vacancy report.. Ms. Chavis-Gomez will be with the department through June 30, 2014.

Ms. Harris also acknowledged Councilman Don Moffitt who was present.

Ms. Watterson made a motion to adjourn the meeting at 7:20pm. Dr. Daniel seconded the motion and the motion was unanimously approved.

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Jim Miller, DVM-Chairman

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Gayle B. Harris, MPH, Public Health Director



# PUBLIC HEALTH PREPAREDNESS

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Pat Gentry, RN  
Public Health Preparedness Coordinator

# Durham County Emergency Operations Plan (EOP)

- The Basic Plan provides the concept of operations for Durham County
- The critical Unit Responsibilities outline the responsibilities for key agencies
- Functional Annexes outline broad functional capabilities common to all types of hazards
- Hazard Specific Appendices outlines specific steps for the effective handling of specific hazards



# The DCoDPH EOP

- The DCoDPH EOP is written in accordance with the Durham County EOP
- This plan is activated in any public health emergency that would exceed our standard operating procedures and includes specific plans such as:
  - Strategic National Stockpile (SNS) Plan
  - Crisis & Emergency / Risk Communications Plan
  - Continuity of Operations Plan ( COOP)



# Role of DC Board of Health During Disasters

- Before requesting SNS medical assets the Durham County Public Health Director will consult with the following local entities: Durham County Manager and Chairperson of the Board of Health. The Durham County Public Health Director will consult with the above entities, optimally, via telephone conference, one on one telephone call, or at the County EOC depending on the circumstances.
- Opportunity to volunteer with the Durham County Medical Reserve Corps to help deliver services to the citizens of Durham County during a disaster.



# Durham County Medical Reserve Corps

- The Durham County Medical Reserve Corps is a group of trained volunteers that are ready and willing to assist during times of emergencies.
- They will assist with: N-95 Fit Testing, Sheltering, SNS Medication Dispensing, SNS Warehouse Duties, Community Health Assessments, etc.



# DCoDPH Preparedness Activities

- Launch Quarterly and Annual Call-downs
- Require Incident Command Training
- Provide Annual N-95 Fit testing
- Working with local business to become closed POD
- Maintain Rapid Response POD Trailers
- Recruit and Train our Medical Reserve Corps
- Develop and Revise Emergency Response Plans
- Participate Meetings and Exercises with other Response Agencies



# DCoDPH Preparedness Goals for 2014

- Identify the At-Risk Population in Durham County
- Develop a Comprehensive Durham County Special Needs Shelter Plan
- Implement an electronic Inventory System to track medications, personnel and other assets during an emergency
- Exercise the DCoDPH SNS Plan while delivering Influenza Vaccinations



“Planning is bringing the future into the present so that you can do something about it now.” Alan Lakein

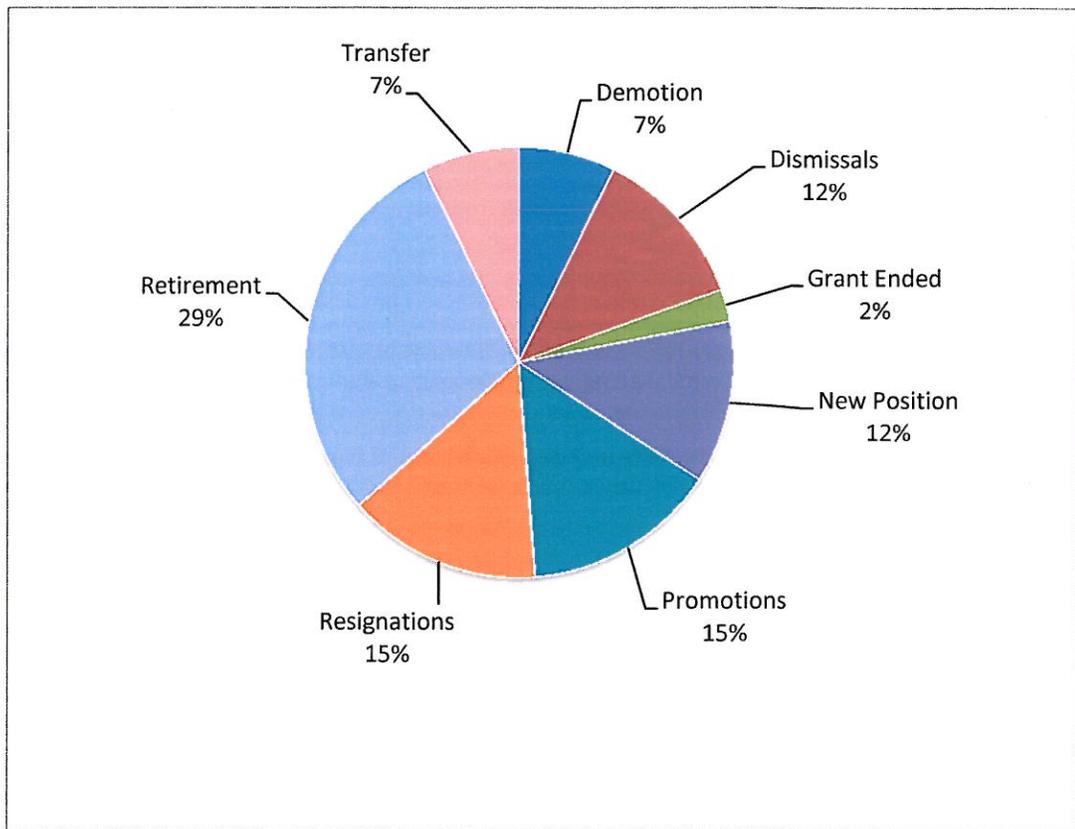
## Durham County Public Health Preparedness

Pat Gentry, RN  
PGENTRY.DCONC.GOV



**PUBLIC HEALTH VACANCY REPORT**  
**July 1, 2013 through May 31, 2014**

| <u>Vacancy Reasons</u> | #         | %   |
|------------------------|-----------|-----|
| Demotion               | 3         | 7%  |
| Dismissals             | 5         | 12% |
| Grant Ended            | 1         | 2%  |
| New Position           | 5         | 12% |
| Promotions             | 6         | 15% |
| Resignations           | 6         | 15% |
| Retirement             | 12        | 29% |
| Transfer               | 3         | 7%  |
| <hr/>                  |           |     |
|                        | <b>41</b> |     |



PUBLIC HEALTH VACANCY REPORT  
JULY 1, 2013 THROUGH MAY 31, 2014

| Position Number | Position Title       | Leave Date   | Recruit Began Date | Recruit End Date  | Start Date | Notes                                 |
|-----------------|----------------------|--------------|--------------------|-------------------|------------|---------------------------------------|
| 40006200        | Local PH Admin I     | 12/12/12     | 9/16/13            | 10/18/13          | 1/6/14     |                                       |
| 40007983        | Finance Officer      | 6/28/13      | 9/11/13            | 10/4/13           | 11/11/13   |                                       |
| 40001091        | PHN Supv I           | 7/9/13       | 7/22/13            | 8/23/13           | 9/2/13     |                                       |
| 40007629        | PHN II               | 7/22/13      | 11/25/13 & 4/24/14 | 2/28/14 & 5/8/14  |            | VACANT-10 month position              |
| 40007576        | CHA                  | 8/16/13      | 9/2/13             | 9/27/13           | 3/17/14    |                                       |
| 40001120        | CHA                  | 8/30/13      | 10/31/13           | on hold           |            | VACANT                                |
| 40001086        | PHN II               | 9/2/13       | 9/16/13            | 10/18/13          | 12/23/13   |                                       |
| 40001004        | PH Education Spec    | 9/6/13       | No Recruit         | No Recruit        | Grant End  | VACANT                                |
| 40001152        | Env Health Spec      | 9/7/13       | 8/29/13 & 1/20/14  | 2/14/14           | 6/9/14     | VACANT                                |
| 40001065        | Data Entry Oper      | 9/27/13      | 9/16/13            | 9/27/13           | 1/6/14     |                                       |
| 40001160        | Env Health Director  | 9/30/13      | 8/12/13            | 10/4/13           | 11/25/13   |                                       |
| 40003626        | PHN II               | 9/30/13      | 9/16/13            | 10/18/13          | 11/25/13   |                                       |
| 40002856        | Dental Hygienist     | 10/10/13     | 11/4/13            | 11/29/13          | 2/17/14    |                                       |
| 40001050        | PHN I                | 10/11/13     | 11/25/13           | 1/24/14           | 3/17/14    |                                       |
| 40007078        | PH Education Spec    | 10/13/13     | 11/25/13           | 12/13/13          |            | VACANT                                |
| 40001138        | PHN II               | 10/13/13     | 1/6/14             | 2/7/14            | 7/7/14     | VACANT                                |
| 40005377        | Nutritionist         | 10/27/13     | 12/16/13           | 2/14/14           | 7/7/14     | VACANT                                |
| 40001342        | Social Worker        | 10/31/13     | 9/16/13            | 10/4/13           |            | VACANT                                |
| 40001119        | PE I from CHA        | 10/31/13     | 4/21/14            | 5/2/14, 5/16/14   |            | VACANT-reclass to PE I eff 3/17/14    |
| 40007578        | PH Education Spec    | 11/11/13     | 11/25/13           | 12/13/13          | 4/14/14    |                                       |
| 40000989        | Office Assistant III | 11/25/13     | 12/2/13            | 12/13/13          | 2/17/14    |                                       |
| 40007501        | PHN III              | 11/25/13     | 12/9/13            | 1/24/14           | 6/23/14    | VACANT                                |
| 40000948        | Proc Assist III      | 11/27/13     | 10/30/13           | 11/5/13           | 11/25/13   |                                       |
| 40007500        | PHN III              | 12/22/13     | 1/6/14 & 4/18/14   | 2/17/14 & 5/2/14  |            | VACANT                                |
| 40006875        | Proc Unit Supv       | 1/1/14       | 1/20/14            | 2/3/14            | 4/28/14    |                                       |
| 40001017        | Van Driver           | 1/14/14      | 1/27/14            | 2/28/14           | 4/28/14    |                                       |
| 40001057        | Physician Extender I | 1/22/14      | 2/17/14 & 4/21/14  | 4/4/14 & 5/16/14  |            | VACANT                                |
| 40001031        | Proc Assist III      | 2/21/14      | No Recruit         | No Recruit        |            | VACANT                                |
| 40001010        | Medical Lab Tech II  | 2/24/14      |                    |                   | 4/28/14    | reclass-Proc Unit Supv IV eff 4/28/14 |
| 40000947        | Proc Assist III      | 3/14/14      | 5/26/14            | 6/6/14            |            | temp employee as of 3/17/14           |
| 40002020        | Office Assistant III | 4/27/14      | 5/26/14            | 6/6/14            |            | VACANT                                |
| 40001042        | Pharmacist I         | 4/30/14      | 5/5/14             | 5/24/14           |            | VACANT                                |
| 40001043        | Pharmacist II        | 4/30/14      | 1/20/14 & 2/17/14  | 2/14/14 & 2/28/14 | 5/1/14     |                                       |
| 40007632        | PHN II               | 5/23/14      | 5/26/14            | 6/6/14            |            | VACANT                                |
| 40005361        | Nutrition Prog Mgr   | 5/30/14      | 5/26/14            | 6/20/14           |            | VACANT                                |
| 40001100        | HS Coord II          | 5/30/14      |                    |                   |            | VACANT                                |
| 40008050        | Nutrition Spec       | new 12/19/13 | 1/13/14            | 4/25/14           |            | VACANT-Req to HR 1/6/14               |
| 40008051        | Nutrition Spec       | new 12/19/13 | 1/13/14            | 4/25/14           |            | VACANT-Req to HR 1/6/14               |
| 40007966        | Env Health Spec      | new 7/18/13  | 1/20/14            | 2/14/14           | 5/12/14    |                                       |
| 40007962        | HS Coord III         | new 7/8/13   | 7/22/13            | 8/9/13            | 12/9/13    |                                       |
| 40007988        | PH Education Spec    | new 9/23/13  | 9/30/13            | 10/18/13          | 11/11/13   |                                       |

**ENVIRONMENTAL HEALTH**  
 Onsite Water Protection Notices of Violation  
 May 2014

| NOV DATE   | SUBJECT PROPERTY ADDRESS | TYPE OF VIOLATION             | NOV EXPIRATION DATE | FORWARDED TO CO. ATTY? | COMPLIANCE STATUS (YES/NO) | COMPLIANCE DATE |
|------------|--------------------------|-------------------------------|---------------------|------------------------|----------------------------|-----------------|
| 11/26/2013 | 3823 Hanford Dr          | Illicit Straight Pipe         | 12/26/2013          | Y                      | N                          |                 |
| 3/14/2013  | 2707 Little River Dr     | Surface discharge of effluent | 4/14/2013           | Y                      | N                          |                 |
| 8/19/2013  | 2121 Fletchers Chapel    | Damaged septic tank           | 9/18/2013           | Y                      | N                          |                 |

|           |                                |  |           |   |   |  |
|-----------|--------------------------------|--|-----------|---|---|--|
| 1/16/2014 | Little River Community Complex | No Subsurface Operator                             | 2/16/2014 | N | N |  |
| 3/12/2014 | 7001 Herndon Rd                | Surface discharge of effluent                      | 4/10/2014 | N | N |  |
| 3/20/2014 | 913 Cartman                    | Surface discharge of effluent onto neighbor's yard | 4/20/2014 | N | N |  |
| 4/17/2014 | 5340 Lake Vista                | Back-up of sewage into septic tank                 | 7/17/2014 | N | N |  |
| 4/21/2014 | 2813 S Roxboro                 | Surface Discharge of effluent                      | 5/21/2014 | N | N |  |
| 4/29/2014 | 5677 Kemp                      | Surface Discharge of effluent                      | 6/29/2014 | N | N |  |

**NOTES**

12/6/2013 House was previously unoccupied. Mr. Durham has moved back in. He has been made aware of the straight pipe, informed to keep the tanks pumped until the issue is resolved and instructed to pursue a discharging permit with DWR. 6/2/2014 - House remains occupied, verified by site visit. NOV will be forwarded to County Attorney's Office.

Application for repair permit has been received, Met septic contractor onsite 3/12/13. System determined to be non-repairable. New NOV issued directing property owner to pursue permit for discharging system through NC DWQ. 9/30/13 - No application has been received by NC DWR. 2/3/2014 - Site visit verified system is still failing. 3/5/2014 - NOV forwarded to County Attorney's office. 3/27/2014 - Owner contacted NC DWR regarding application for discharging permit. 6/2/14 - Verified with DWR that owner has applied, hired and engineer, and is moving forward with the permit process.

9/4/2013 clarified repair question via email. Still need a repair application to replace the tank. 10/7/2013, application has been received and the repair permit has been issued, waiting for installation. 2/3/2013 - Site visit performed by EH staff. House is occupied and tank has not been replaced. 3/5/2014 - NOV forwarded to County Attorney's office. 3/14/14 - Letter received from owner's attorney stating that owner has contracted with an installer. 30 extension granted by Env. Health to allow ground wetness conditions to improve prior to installation. 4/21/2014 - Contacted by Joel Glass (installer) about requirements for tank installation. No appointment has been scheduled. 6/2/2014 - Owner continues to delay installation of replacement septic tank. Legal action is recommended.

No Subsurface Operator. Meeting with potencial operator 3/3/2014. Meeting rescheduled for 3/10/2014 due to inclement weather. Facility management has been instructed to have tanks pumped and to save receipts. 3/19/2014 - Electrician repaired power control, restored power to effluent pumps. Facility management has been negotiating with certified operators. No contract submitted to Env. Health as of 4/1/2014. 4/29/14 - Manager notified by EH to comply immediately to avoid legal action. 5/30/2014 Management continues to delay regarding a certified operator. NOV will be forwarded to County Attorney's office.

3/10/2014 - Site visit, confirmed surfacing effluent. Municipal sewer available. 6/1/14 Owner has applied for sewer connection and is awaiting tap installation.

3/20/2014 - The complaint is valid. Issued NOV 4/29/2014 - Return visit made by EH, course of action to remedy failure communicated to owner.

Property owners contacted Env. Health for repair evaluation. Parcel does not have sufficient available space for a repair drainfield. Referred owners to NC DWR for NPDES permit.

Verified failing system 4/10/2014. Sewer is available. NOVs issued by Environmental Health and City of Durham Stormwater Services. 4/24/2014

Sewage is ponding over the drainfield. Landscape position has been changed to a toe slope due to significant imported fill. System is serving an office and 2 bedroom trailer, but is permitted only for the office. 5/29/2014 - Owner is deceased. 30 day extension for NOV granted at the request of estate executor.

## NOV Highlights for May 2014

**3903 Hanford** – Removed from list, accessory dwelling has been removed from the site and no signs of system failure were observed on 6/2/2014.

**8 Steepleton Ct** – Removed from list, owner has hired a certified operator. System is now compliant.

**2709 Cooksbury** – Removed from list, house was reconnected to municipal sewer upon court order.

**3038 Tavistock** – Removed from list, owner has cooperated with Environmental Health and reduced water use has abated the system failure. Accessory structure was determined not to be a dwelling.

**2804 Darrow Rd** – Removed from list, house was reconnected to municipal sewer.

**3823 Hanford** - Mobile home remains occupied with an illicit straight pipe discharge. Legal action recommended.

**2707 Little River Dr** – Owner is actively pursuing system replacement. An application has been submitted to NC DWR and the owner has hired an engineer to design a new system.

**2121 Fletchers Chapel** – Owner continues to delay septic tank replacement. Legal action recommended.

**Little River Community Complex** – Facility management continues to delay contracting a certified wastewater operator. NOV will be forwarded to County Attorney's office.

**7001 Herndon** – Owner has applied for sewer connection and is awaiting installation of tap by City of Durham.

**5677 Kemp** – Owner is deceased. Estate executor requested a 30 day extension. Request was granted; NOV will expire 6/29/2014.

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## SECTION .2500 - PUBLIC SWIMMING POOLS

Rules .2501 - .2507 of Title 15A Subchapter 18A of the North Carolina Administrative Code (T15A.18A .2501 - .2507); have been transferred and recodified from Rules .2501 - .2507 Title 10 Subchapter 10A of the North Carolina Administrative Code (T10.10A .2501 - .2507), effective April 4, 1990.

|                           |   |
|---------------------------|---|
| <b>15A NCAC 18A .2501</b> | <b>DEFINITIONS</b>                            |
| <b>15A NCAC 18A .2502</b> | <b>PUBLIC SWIMMING POOL OPERATION PERMITS</b> |
| <b>15A NCAC 18A .2503</b> | <b>INSPECTIONS</b>                            |
| <b>15A NCAC 18A .2504</b> | <b>DESIGN AND CONSTRUCTION STANDARDS</b>      |
| <b>15A NCAC 18A .2505</b> | <b>WATER QUALITY STANDARDS</b>                |
| <b>15A NCAC 18A .2506</b> | <b>REVOCATION OF PERMITS</b>                  |
| <b>15A NCAC 18A .2507</b> | <b>APPEALS</b>                                |

*History Note:* Authority S.L. 1989, c. 577;  
Eff. May 1, 1990;  
Repealed Eff. May 1, 1991.

**15A NCAC 18A .2508 DEFINITIONS**

The following definitions apply throughout this Section:

- (1) Equipment replacement means replacement of individual components of the hydraulic and disinfection systems such as pumps, filters, and automatic chemical feeders.
- (2) Public swimming pool means public swimming pool as defined in G.S. 130A-280. Public swimming pools are divided into four types:
  - (a) Swimming pools are public swimming pools used primarily for swimming.
  - (b) Spas are public swimming pools designed for recreational and therapeutic use that are not drained, cleaned, or refilled after each individual use. Spas may include units designed for hydrojet circulation, hot water, cold water mineral bath, air induction bubbles, or any combination thereof. Common terminology for spas includes "therapeutic pool", "hydrotherapy pool", "whirlpool", "hot spa", and "hot tub".
  - (c) Wading pools are public swimming pools designed for use by children, including wading pools for toddlers and children's activity pools designed for casual water play ranging from splashing activity to the use of interactive water features placed in the pool.
  - (d) Specialized water recreation attractions are pools designed for special purposes that differentiate them from swimming pools, wading pools and spas. They include:
    - (i) water slide plunge pools and run out lanes;
    - (ii) wave pools;
    - (iii) rapid rides;
    - (iv) lazy rivers;
    - (v) interactive play attractions that incorporate devices using sprayed, jetted, or other water sources contacting the users and that do not incorporate standing or captured water as part of the user activity area; and
    - (vi) training pools deeper than a 24 inch deep wading pool and shallower than a 36 inch deep swimming pool.
- (3) Registered Design Professional means an individual who is registered or licensed to practice engineering as defined by G.S. 89C or architecture as defined by G.S. 83A.
- (4) Remodeled means renovations requiring disruption of the majority of the pool shell or deck, changes in the pool profile, or redesign of the pool hydraulic system.
- (5) Repair means returning existing equipment to working order, replastering or repainting of the pool interior, replacement of tiles or coping and similar maintenance activities. This term includes replacement of pool decks where the Department has determined that no changes are needed to underlying pipes or other pool structures.
- (6) Safety vacuum release system means a system or device capable of providing vacuum release at a suction outlet caused by a high vacuum occurrence due to suction outlet flow blockage.

- (7) Splash zone means the area of an interactive play attraction that sheds water to a surge tank or container to be recirculated.
- (8) Unblockable drain means a drain of any size and shape that a human body cannot sufficiently block to create a suction entrapment hazard.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Temporary Amendment Eff. June 1, 1994 for a period of 180 days or until the permanent rule becomes effective, whichever is sooner;  
Amended Eff. May 1, 2010; March 1, 2004; April 1, 1999; January 1, 1996; October 1, 1994.

#### **15A NCAC 18A .2509 PLAN REVIEW AND APPROVAL**

(a) Public swimming pools plans and specifications shall be prepared by a registered design professional if required by G.S. 89C Engineering or G.S. 83A Architecture, and shall be approved by the Department prior to construction. If required by G.S. 87-1 General Contractors, public swimming pools shall be constructed by swimming pool contractors licensed by the North Carolina Licensing Board for General Contractors.

(b) The owner shall submit a minimum of two complete sets of plans to the local Health Department for review. Plans shall be drawn to scale and accompanied by specifications so as to permit a clear, comprehensive review by the local health department. All prints of drawings shall be a minimum of 18 x 24 inches and a maximum size of 36 x 42 inches. These plans shall include:

- (1) Plan and sectional view dimensions of both the pool and the area enclosed by the barrier fences to include the bathhouse and the equipment room and pool accessories;
- (2) Specifications of all treatment equipment used and their layout in the equipment room;
- (3) A piping schematic showing piping, pipe size, inlets, main drains, skimmers, gutter outlets, vacuum fittings and all other appurtenances connected to the pool-piping system;
- (4) Layout of the chemical storage room; and
- (5) Specifications for the water supply and wastewater disposal systems that include aspects such as well location and backwash water disposal where applicable.

(c) The Department shall approve, disapprove, or provide written comments on plans and specifications for public swimming pools within 30 days of their receipt. If such action is not taken within 30 days, the plans and specifications shall be deemed approved.

(d) If construction is not initiated within one year from the date of approval, the approval is void.

(e) The swimming pool contractor shall contact the local health department when pool pipes are in place and visible so that the local health department may conduct an open-pipe inspection of the pool piping.

(f) Prior to issuance of the operation permit, the owner shall submit to the local health department a statement signed by a registered design professional stating that construction is complete and in accordance with approved plans and specifications and approved modifications. Observation of construction and a final inspection for design compliance by the certifying registered design professional or his representative are required for this statement.

(g) Upon completion of construction, the contractor shall notify the local health department and the owner. The contractor shall provide the owner with a complete set of drawings, which show as built, the location of all pipes and the connections of all equipment and written operating instructions for all equipment.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. May 1, 2010; July 1, 1992.

#### **15A NCAC 18A .2510 PUBLIC SWIMMING POOL OPERATION PERMITS**

(a) No public swimming pool shall commence or continue operation unless the owner or operator has an operation permit issued by the Department for each public swimming pool. Unless suspended or revoked, the operation permit shall be valid for the period of operation specified in the application but in no event shall it be valid for more than 12 months. For public swimming pools which are constructed or remodeled, plans and specifications shall have been approved by the Department in accordance with Rule .2509. Compliance with the design and construction requirements in Rules .2514 through .2534 and approval of plans and specifications shall not be required for public swimming pools constructed or remodeled prior to May 1, 1993. No public swimming pool shall commence or continue operation after May 1, 2010 unless documentation of compliance with pool drain safety requirements of Rule .2539 of this Section has been submitted to the local health department.

(b) Equipment replacement shall comply with Rules .2514 through .2534 and shall be approved by the Department prior to installation. However, for existing swimming pools with recirculation systems unable to meet the pool volume turnover rates specified in the rules of this Section, pump replacement shall match the flow capabilities of the system. Repairs do not require prior approval by the Department.

(c) A separate application for an operation permit must be submitted for each public swimming pool. The owner or operator shall apply annually to the Department for an operator's permit. The application form shall be obtained from the Department and shall include the following information:

- (1) the owner's name, address, and phone number;
- (2) the operator's name, address, and phone number;
- (3) street address of the public swimming pool;
- (4) the physical location of the public swimming pool;
- (5) type of public swimming pool;
- (6) construction date;
- (7) proposed operating dates;
- (8) type of disinfection; and
- (9) signature of owner or designated representative.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. May 1, 2010; January 1, 1996.

#### 15A NCAC 18A.2511 INSPECTIONS

(a) Each public swimming pool shall be inspected by the Department to determine compliance with the rules of this Section. Where an operation permit is issued prior to inspection of a public swimming pool, an inspection shall be completed within 60 days following issuance of the permit. Pools that open on or after April 1 and close on or before October 31 shall be inspected at least once during the period of operation. All other pools shall be inspected at least twice a year.

(b) Inspections of public swimming pools shall be conducted by Environmental Health Specialists authorized by the Department to enforce the rules of this Section. Inspections shall be documented on Inspection of Swimming Pool Form DENR 3960. Items on the grade sheet shall be divided into two, four and six-demerit items. Six-demerit items are failures to maintain minimum water quality or safety standards and warrant immediate suspension of an operation permit under G.S. 130A-23(d). Four-demerit items are rule violations which warrant denial of an operation permit or notification of an intent to suspend an operation permit. Two-demerit items are rule violations that do not warrant permit action unless such violation causes an imminent hazard, a failure to meet water quality or safety standard, or a suction hazard. Demerits shall be assessed for each item found not to be in compliance with the rules of this Section. Demerits shall be assessed as follows:

- (1) Violation of Rule .2535(2) of this Section regarding water clarity shall be assessed six demerits.
- (2) Violation of Rule .2531(a)(10), .2531(b)(3), .2535(3), (4), (5), (7), (8), or (9), or .2543(d)(7) or (e)(2) of this Section regarding disinfectant residuals shall be assessed six demerits.
- (3) Violation of Rule .2535(1) of this Section regarding pool water pH shall be assessed six demerits.
- (4) Violation of Rule .2535(12) of this Section or regarding control of water temperature in heated pools shall be assessed six demerits.
- (5) Violation of Rule .2535(10), (11), or (13), .2537(c), or .2540 of this Section regarding pool operator training, water quality records and test kits shall be assessed four demerits.
- (6) Violation of Rule .2518(j), .2537(b)(7) or (16), or .2539 of this Section regarding pool drains and suction hazards shall be assessed six demerits.
- (7) Violation of Rule .2537(b)(3), (8), (9) or (14) of this Section regarding maintenance of pool walls and floor shall be assessed four demerits.
- (8) Violation of Rule .2518(k) or (l), .2531(4), .2532(4)(b) or .2537(b)(14) of this Section regarding water surface skimmers shall be assessed four demerits.
- (9) Violation of Rule .2523 or .2537(b)(6) of this Section regarding depth markers and no diving markers shall be assessed four demerits.
- (10) Violation of Rule .2515(d) or (f), .2523(e) or .2537(b)(12) of this Section regarding floating safety ropes and contrasting color bands at breakpoints shall be assessed two demerits.

- (11) Violation of Rule .2517, .2521, .2527, .2537(b)(10), .2527, or .2542 of this Section regarding diving equipment, slides, ladders, steps, handrails and in-pool exercise equipment shall be assessed two demerits.
- (12) Violation of Rule .2518(i) or .2537(b)(8) of this Section regarding inlets and other fittings shall be assessed four demerits.
- (13) Violation of Rule .2516(b), .2521(b)(4), .2532(13) or .2537(b)(12) of this Section regarding contrasting color bands on seats or benches shall be assessed four demerits.
- (14) Violation of Rule .2532(7) or .2537(b)(11) of this Section regarding spa timers shall be assessed four demerits.
- (15) Violation of Rule .2530(a), or (b), or .2537(b)(1) of this Section regarding lifesaving equipment shall be assessed six demerits.
- (16) Violation of Rule .2528, .2531(a)(7) or .2537(b)(5) of this Section regarding fences, barriers and gates shall be assessed four demerits.
- (17) Violation of Rule .2522 or .2537(b)(2) of this Section regarding decks shall be assessed four demerits.
- (18) Violation of Rule .2530(c) of this Section regarding No Lifeguard warning signs shall be assessed four demerits.
- (19) Violation of Rule .2530(d) or .2543(d)(13) of this Section regarding pet and glass container signs shall be assessed four demerits.
- (20) Violation of Rule .2532(15) through (17), or .2537(b)(13) of this Section regarding caution signs at hot water spas shall be assessed four demerits.
- (21) Violation of Rule .2524, or .2537(b)(4) of this Section regarding pool and deck lighting and ventilation shall be assessed four demerits.
- (22) Violation of Rule .2530(f) of this Section regarding emergency telephones shall be assessed six demerits.
- (23) Violation of Rule .2535(6) of this Section regarding automatic chlorine or bromine feeders shall be assessed four demerits.
- (24) Violation of Rule .2518, .2519, .2525, .2531(a)(1) through (3), .2532(1) through (6), or .2543(b), (d)(1) through (6) or (e)(1) of this Section regarding pool filter and circulation systems shall be assessed four demerits.
- (25) Violation of Rule .2533, .2534 or .2537(b)(15) of this Section regarding equipment rooms and chemical storage rooms shall be assessed two demerits.
- (26) Violation of Rule .2518(d) of this Section regarding identification of valves and pipes shall be assessed two demerits.
- (27) Violation of Rule .2513(b) of this Section regarding air gaps for filter backwash shall be assessed two demerits.
- (28) Violation of Rule .2526 or .2543(d)(11) of this Section regarding accessible dressing and sanitary facilities shall be assessed two demerits.
- (29) Violation of Rule .2526 of this Section regarding maintenance and cleaning of dressing and sanitary facilities and fixtures shall be assessed two demerits.
- (30) Violation of Rule .2512 of this Section regarding water supplies shall be assessed two demerits.
- (31) Violation of Rule .2513(a) of this Section regarding sewage disposal shall be assessed two demerits.
- (32) Violation of Rule .2526(c) of this Section regarding floors in dressing and sanitary facilities shall be assessed two demerits.
- (33) Violation of Rule .2526(c), or (d) of this Section regarding hose bibs and floor drains in dressing and sanitary facilities shall be assessed two demerits.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. May 1, 2010; March 1, 2004; January 1, 1996.

#### **15A NCAC 18A .2512 WATER SUPPLY**

(a) The water supply serving the swimming pool and all plumbing fixtures including drinking fountains, lavatories, toilets, and showers, shall meet all requirements in 15A NCAC 18A .1700 or be an approved public water supply in

accordance with 15A NCAC 18C. However, the Department may approve the use of water from natural sources, including the use of saline water, for the swimming pool.

(b) The water distribution system serving the swimming pool and auxiliary facilities shall be protected against backflow. Water introduced into the pool, either directly or by the circulation system, shall be supplied through an air gap (American National Standards Institute A112.1.2-1979), a pipe-applied atmospheric vacuum breaker (ANSI/American Society of Sanitary Engineering No. 1001-1971), a pressure type anti-siphon vacuum breaker (ANSI/ASSE No. 1020-1976), or a reduced-pressure principle backflow preventer (ASSE No. 1013-1979, American Water Works Association No. C506-1978), which are hereby adopted by reference in accordance with G.S. 150B-14(c) or equivalent.

(c) Whenever an over-the-rim spout is used to introduce water into the swimming pool, it shall be shielded so as not to create a hazard. The open end of the spout shall have no sharp edges, shall not protrude more than two inches (5.1 cm) beyond the edge of the pool and shall be at least two pipe diameters above the deck or pool overflow level. The over-the-rim spout shall be located under the diving board or within six inches of a ladder or handrail.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991.

#### **15A NCAC 18A .2513 SEWAGE SYSTEMS AND OTHER WASTEWATER DISPOSAL**

(a) Sewage shall be disposed of in a public sewer system or, in the absence of a public sewer system, by an approved, properly operating sanitary sewage system.

(b) There shall be no direct physical connection between the sewer system and any drain from the swimming pool or circulation system. Overflow from the swimming pool, and discharges from the circulation system, when discharged to the sewer system, storm drain or other approved natural drainage course, shall be discharged through a suitable air gap so as to preclude the possibility of back flow of sewage or other waste water into the swimming pool or the swimming pool piping system. Deck drainage shall be discharged through an indirect drain.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. April 1, 1999; July 1, 1992.

#### **15A NCAC 18A .2514 MATERIALS OF CONSTRUCTION**

(a) Pools and appurtenances shall be constructed of materials which are inert, non-toxic to man, impervious and permanent, which can withstand design stresses and which can provide a water-tight tank with a smooth and cleanable surface. Use of vinyl liners is prohibited; however, liners no less than 60 mil thick may be used provided the underlying pool shell is of approved construction. If this material is used for repairs, the existing pool shall be remodeled in accordance with this Rule.

(b) Sand or earth bottoms are prohibited in swimming pool construction.

(c) Pool finish, including bottom and sides, shall be of white or light colored material determined visually to contrast least with a value of gray whiter than 50 percent black on an artists gray scale, or shown by reflectance testing to reflect more than 50 percent of visible light.

(d) Pool surfaces in areas which are intended to provide footing for bathers including steps, ramps, and pool bottoms in areas with water less than three feet deep, shall be designed to provide a slip-resistant surface.

*History Note:* Authority G.S. 130A-82;  
Eff. May 1, 1991;  
Amended Eff. May 1, 2010.

#### **15A NCAC 18A .2515 DESIGN DETAILS**

(a) Pools shall be designed and constructed to withstand all loadings for both full and empty conditions.

(b) A hydrostatic relief valve shall be provided for in-ground swimming pools which extend more than two feet below the grade of surrounding land surface unless a gravity drainage system is provided.

(c) Provisions shall be made for complete, continuous circulation of water through all areas of the swimming pool. Swimming pools shall have a circulation system with approved treatment, disinfection, and filtration equipment as required in the rules of this Section.

- (d) The minimum depth of water in the swimming pool shall be three feet (0.91 m) except where a minimum depth of less than three feet is needed to provide non-swimming areas such as children's activity areas and sun shelves.
- (e) The maximum depth at the shallow end of a swimming pool shall be three and a half feet (1.07 m) except for pools used for competitive swimming, diving or other uses which require water deeper than three and a half feet.
- (f) Connections for safety lines shall be recessed in the walls in a manner which presents no hazard to swimmers.
- (g) Decorative features such as planters, umbrellas, fountains and waterfalls located on pool decks shall comply with the following:
- (1) Decorative features shall not occupy more than 20 percent of the pool perimeter;
  - (2) If located adjacent to a water depth of greater than five feet, decorative features shall not be more than 20 feet wide;
  - (3) Decorative features shall not provide handholds or footholds that could encourage climbing above deck level;
  - (4) A walkway shall be provided to permit free access around decorative features and shall be as wide as the lesser of five feet or the deck width required in Rule .2528 of this Section;
  - (5) Decorative features shall not obstruct the view of any part of the pool from any seating area; and
  - (6) Features with moving water shall be separate from the pool recirculation system.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. May 1, 2010; August 1, 2000; April 1, 1999.

#### **15A NCAC 18A .2516 POOL PROFILE**

- (a) The vertical walls of a public swimming pool shall not exceed 11 degrees from plumb. Corners formed by intersection of walls and floors shall be coved or radiused. Hopper bottomed pools are prohibited.
- (b) Underwater ledges or protrusions are prohibited; except that underwater stairs, sun shelves, seats and benches may be installed in areas of the pool no more than four feet deep. Underwater benches shall have a maximum seat depth of two feet from the water surface, protrude no more than 18 inches from the wall and be marked by a two inch contrasting color band on the leading edge. Underwater protrusions may provide seating at swim-up bars located in offset areas away from swim lanes. Underwater stairs may adjoin a sun shelf to deeper water provided the depth at the bottom of the stairs is no more than four feet and the stairs meet all provisions of Rule .2521 of this Section.
- (c) The slope of the bottom of any portion of any public swimming pool having a water depth of less than five feet (1.52 m) shall not be more than one foot vertical change in 10 feet (10 cm in one meter) of horizontal distance and the slope shall be uniform.
- (d) In portions of pools with water depths greater than five feet (1.52 m), the slope of the bottom shall not be more than one foot vertical in three feet (33.3 cm in one meter) of horizontal distance.
- (e) Design of diving areas shall be in accordance with Tables 1A and 1B of Rule .2517 of this Section.
- (f) Fountains installed in public swimming pools shall be approved prior to installation and shall comply with the following:
- (1) Fountains shall not be installed in an area with a water depth exceeding 18 inches;
  - (2) Fountains shall be recommended by the manufacturer for use in a public swimming pool;
  - (3) Fountains shall be installed in accordance with the manufacturer's instructions;
  - (4) Fountains shall be separate from the pool water recirculation system; and
  - (5) Fountains shall not release water at a velocity greater than 10 feet per second.

*History Note:* Authority G.S. 130A-82;  
Eff. May 1, 1991;  
Amended Eff. May 1, 2010; February 1, 2004; January 1, 1996.

#### **15A NCAC 18A .2517 DIVING EQUIPMENT**

- (a) When diving equipment is installed in a public swimming pool, it shall be located in the diving area of the pool so as to provide the minimum dimensions as shown in Tables 1A and 1B of this Rule and shall conform to the following specifications:
- (1) Diving equipment shall be designed for swimming pool use and shall be installed in accordance with the manufacturer's recommendations.
  - (2) Installation instructions and specifications shall be provided with each unit.

- (3) A label shall be permanently affixed to the diving equipment and shall include:
  - (A) manufacturer's name and address;
  - (B) board length;
  - (C) type of diving board;
  - (D) fulcrum setting specifications if applicable.
- (4) Diving equipment shall have slip-resistant tread surfaces.
- (b) Supports, platforms, and steps for diving equipment shall be of sufficient strength to carry safely the maximum anticipated loads. Steps shall be of corrosion-resistant design. Handrails shall be provided at all steps and ladders leading to diving boards that are one meter or more above the water.
- (c) There shall be a completely unobstructed clear vertical distance of 13 feet above any diving board measured from the center of the front end of the board. This area shall extend horizontally at least eight feet behind, eight feet to each side, and 16 feet ahead of Point A in Table 1A.

Table 1A

| Maximum Board Length | Maximum Board Height Above Water | Board Overhang (Pt. A) |        | Minimum Water Depths |       |       |
|----------------------|----------------------------------|------------------------|--------|----------------------|-------|-------|
|                      |                                  | Max                    | Min    | D1                   | D2    | D3    |
| 12 feet              | 30 in                            | 5 feet                 | 4 feet | 8'0"                 | 9'0"  | 8'3"  |
| 16 feet              | 1 meter                          | 6 feet                 | 5 feet | 8'6"                 | 10'0" | 8'6"  |
| 16 feet              | 3 meters                         | 6 feet                 | 5 feet | 11'6"                | 12'0" | 11'6" |

KEY TO ABBREVIATIONS:

Pt A is the point on the water line of the pool directly beneath the end of the diving board.  
 D1 is the depth of the water measured from the water line to the floor at the beginning of the radius connecting the end wall with the floor at the deep end of the pool.  
 D2 is the depth of the water at the deepest point in the pool.  
 D3 is the depth of the water at the point where the deep area of the pool meets the transition to the shallow area of the pool.

Table 1B

| Maximum Board Length | Horizontal Distances |    |       |       |      |     | Minimum Pool Width | Minimum Separation Distances |     |
|----------------------|----------------------|----|-------|-------|------|-----|--------------------|------------------------------|-----|
|                      | L1                   | L2 | L3    | L4    | L5   | L6  |                    | F                            | G   |
|                      | 12 feet              | 3' | 7'    | 10'3" | 9'9" | 30' |                    | 4'                           | 20' |
| 16 feet              | 5'                   | 5' | 11'6" | 10'6" | 32'  | 4'  | 24'                | 12'                          | 10' |
| 16 feet              | 5'                   | 5' | 7'6"  | 19'6" | 37'  | 3'  | 28'                | 14'                          | 12' |

KEY TO ABBREVIATIONS:

L1 is the radius of the curve connecting the side wall to the floor at the deep end of the pool.  
 L2 is the distance between the center of the radius connecting the end wall to the floor at the deep end of the pool and the deepest point in the pool.  
 L3 is the distance between the deepest point in the pool and the beginning of the transition to the shallow area of the pool.  
 L4 is the length of the transition zone.  
 L5 is the total of L1 + L2 + L3 + L4.  
 L6 is the length of the shallow area of the pool.

F is the distance between the side wall of the pool and the centerline of the diving board.

G is the distance between the center lines of two adjacent diving boards.

(d) Public pools with diving facilities in excess of three meters in height, or pools designed for platform diving, shall meet the Federation Internationale De Nation Amateur (FINA) guidelines that are incorporated by reference in accordance with G.S. 130B-21.6 including any subsequent amendments or additions.

(e) Starting platforms used for racing starts during competition shall be secured from use when the pool is open for general use by removal; covering; or signage and active supervision. Minimum water depth for starting platforms shall be measured at a distance of 3 feet, 3 ½ inches (1.0 meter) to 16 feet, 5 inches (5.0 meters) from the end wall. Height of starting platforms shall not exceed the following:

- (1) In pools with water depth less than 3 feet, 6 inches (1.07 meters) at the starting end, raised starting platforms shall be prohibited.
- (2) In pools with water depth 3 feet, 6 inches (1.07 meters) to less than 4 feet (1.22 meters) at the starting end, starting platforms shall be no more than 18 inches (0.46 meter) above the water surface.
- (3) In pools with a water depth of 4 feet (1.22 meters) or greater at the starting end, starting platforms shall be no more than 30 inches (0.762 meter) above the surface of the water. Starting platforms shall be constructed to be easily removed from the deck when the swimming pool is used for other than competitive purposes.

*History Note: Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. February 1, 2004; April 1, 1999; January 1, 1996.*

#### **15A NCAC 18A .2518 CIRCULATION SYSTEM**

(a) Pools shall be equipped with a circulation system.

(b) The capacity of the circulation system shall be sufficient to clarify and disinfect the entire volume of swimming pool water four times in 24 hours. The system shall be operated 24 hours per day during the operating season.

(c) The circulation piping shall be designed and installed with the necessary valves and pipes so that the flow from the swimming pool can be from main drains or the surface overflow system. The circulation piping shall be designed such the flow of water from the swimming pool can be simultaneous from the surface overflow system and the main drains. Skimmer piping constructed after May 1, 2010 shall be sized to handle the maximum flow rate for the required number of skimmers, but in no case less than 100 percent of the design flow rate. Perimeter overflow system piping constructed after May 1, 2010 shall be sized to handle 100 percent of the design flow rate. The main drain piping constructed after May 1, 2010 shall be sized to handle 100 percent of the design flow rate.

(d) Piping shall be designed to reduce friction losses to a minimum and to carry the required quantity of water at a maximum velocity not to exceed six feet per second for suction piping and not to exceed 10 feet per second for discharge piping except for copper pipe where the velocity shall not exceed eight feet per second. Piping shall be of non-toxic material, resistant to corrosion, and able to withstand operating pressures. If plastic pipe is used, a minimum of Schedule 40 PVC is required. Flexible pipe shall not be used except that flexible PVC hoses that meet NSF Standard 50 may be affixed to spa shells where rigid pipes do not provide the necessary angles to connect circulation components. Exposed pipes and valves shall be identified by a color code or labels.

(e) The circulation system shall include a strainer to prevent hair, lint, and other debris from reaching the pump. A spare basket shall be provided. Strainers shall be corrosion-resistant with openings not more than ¼ inch (6.4 mm) in size that provide a free flow area at least four times the cross-section area of pump suction line and are accessible for daily cleaning.

(f) A vacuum cleaning system shall be provided to remove debris and foreign material that settles to the bottom of the swimming pool. Where provided, integral vacuum ports shall be located on the pool wall at least six inches and no greater than 18 inches below the water level. Skimmer vacuums may be used in pools with two or fewer skimmers provided the skimmer basket remains in place while the vacuum is in operation. Integral vacuum cleaning systems shall be provided with valves and protective caps. Integral vacuum ports constructed after May 1, 2010 shall have self-closing caps designed to be opened with a tool.

(g) A rate-of-flow indicator, reading in liters or gallons per minute, shall be installed on the filtered water line and located so that the rate of circulation is indicated. The indicator shall be capable of measuring flows that are at least 1½ times the design flow rate, shall be accurate within 10 per cent of true flow, and shall be easy to read. The indicator shall be installed in accordance with manufacturers' specifications.

(h) A pump or pumps shall be provided with capacity to recirculate the swimming pool water four times in 24 hours, and shall be so located as to eliminate the need for priming. If the pump or pumps, or suction piping is located above the overflow level of the pool, the pump or pumps shall be self-priming. The pump or pumps shall be capable of providing a flow adequate for the backwashing of filters. Unless headloss calculations are provided by the designing engineer, pump design shall be based on an assumed total dynamic head of 65 feet of water. Pumps three horsepower or smaller shall be NSF International (NSF) listed or verified by an independent third-party testing laboratory to meet all applicable provisions of NSF/ANSI Standard 50 which is incorporated by reference including any subsequent amendments or editions. Copies may be obtained from NSF International, P.O. Box 130140, Ann Arbor, MI 48113-0140 at a cost of one hundred fifty-five dollars (\$155.00). Verification shall include testing and in-plant quality control inspections. Larger pumps for which NSF listing is not available shall be approved by the Department on a case-by-case basis.

(i) Inlets.

- (1) Inlets shall be provided and arranged to produce a uniform circulation of water and maintain a uniform disinfectant residual throughout the pool.
- (2) The number of inlets for any swimming pool shall be determined based on return water flow. There shall be at least one inlet per 20 gallons per minute of return water flow. There shall be a minimum of four inlets for any swimming pool.
- (3) Inlets shall be located so that no part of the swimming pool is more than 25 feet of horizontal distance from the nearest return inlet.
- (4) Provision shall be made to permit adjustment of the flow through each inlet, either with an adjustable orifice or provided with replaceable orifices to permit adjustments of the flows.

(j) Drains.

- (1) Public Swimming pools with suction drains shall be provided with at least two main drain outlets which are located at the deepest section of the pool and connected by "T" piping. Connecting piping shall be sized and configured such that blocking any one drain will not result in flow through the remaining drain cover/grates exceeding the cover/grate manufacturer's safe flow rating while handling 100 percent of the pump system flow. The drains shall be capable of permitting the pool to be emptied completely. Drains shall be spaced not more than 30 feet apart, and not more than 15 feet away from the side walls. Drains shall be separated by at least three feet measured from centers of the cover/grates. This shall not preclude construction of a public swimming pool without main drains where water is introduced at the bottom of the pool and removed through a surface overflow system designed to handle 100 percent of the design flow rate. Provision shall be made to completely drain pools constructed without drains. Public swimming pools constructed prior to May 1, 2010 with a single drain or multiple drains closer than three feet apart shall protect against bather entrapment with an unblockable drain or a secondary method of preventing bather entrapment in accordance with Rule .2539 of this Section.
- (2) Drain outlets shall comply with the American National Standard ASME/ANSI A112.19.8-2007 Suction Fittings for Use in Swimming Pools, Wading Pools, Spas, and Hot Tubs which is hereby incorporated by reference including any subsequent amendments, editions, and successor standards under the Virginia Graeme Baker Pool and Spa Safety Act (15 U.S.C. 8001 et seq.). Copies may be obtained from ASME, P.O. Box 2300, Fairfield, NJ 07007-2300 at a cost of fifty-three dollars (\$53.00).
- (3) Public swimming pools constructed after May 1, 2010 shall comply with ANSI/APSP -7 2006 American National Standard for Suction Entrapment Avoidance in Swimming Pools, Wading Pools, Spas, Hot Tubs and Catch Basins which is hereby incorporated by reference including any subsequent amendments and editions. Copies may be obtained from APSP, 2111 Eisenhower Avenue, Alexandria, VA 22314 at a cost of three hundred fifty dollars (\$350.00).

(k) Surface Overflow Systems.

- (1) Swimming pools shall be provided with a surface overflow system that is an integral part of the circulation system and that consists of a built-in-place perimeter overflow system, a pre-fabricated perimeter overflow system, or recessed automatic surface skimmers.
- (2) Whenever a built-in-place perimeter overflow system or a pre-fabricated perimeter overflow system is provided, it shall be designed and installed as follows:
  - (A) The system shall be capable of handling 100 percent of the circulation flow without the overflow troughs being flooded;

- (B) A surge capacity shall be provided either in the system or by use of a surge tank; and the total surge capacity shall be at least equal to one gallon per square foot (41L per square meter) of swimming pool water surface area;
  - (C) The water level of the swimming pool shall be maintained above the level of the overflow rim of the perimeter overflows, except for the time needed to transfer all of the water that may be in the surge capacity back into the swimming pool after a period of use; provided that this transfer time shall not be greater than 20 minutes;
  - (D) When installed the tolerance of the overflow rim shall not exceed  $\frac{1}{4}$  inch (6.4 mm) as measured between the highest point and the lowest point of the overflow rim;
  - (E) During quiescence, the overflow system shall be capable of providing continuously and automatically a skimming action to the water at the surface of the swimming pool;
  - (F) The overflow troughs shall be installed completely around the perimeter of the swimming pool, except at steps, recessed ladders and stairs;
  - (G) The exposed surfaces of the overflow trough shall be capable of providing a firm and safe hand-hold; and
  - (H) The overflow trough shall be cleanable and shall be of such configuration as to minimize accidental injury.
- (3) Whenever a recessed automatic surface skimmer or skimmers are installed, they shall be designed and constructed in accordance with Section 8 of NSF Standard #50 for circulation system components for swimming pools, spas, or hot tubs. Recessed automatic surface skimmers shall be installed as follows:
- (A) The flow-through rate through any one recessed automatic surface skimmer shall be between 20 gallons per minute and the maximum flow the skimmer is certified for under NSF Standard Number 50;
  - (B) There shall be at least one recessed automatic surface skimmer for each 400 square feet of water surface area of the swimming pool or fraction thereof;
  - (C) When two or more recessed automatic surface skimmers are required, they shall be so located as to minimize interference with each other and as to insure proper and complete skimming of the entire swimming pools water surface; and
  - (D) Skimmers shall not protrude into the swimming pool. Automatic surface skimmer or skimmers without a perimeter overflow system shall be installed so that the operating level of the pool is no more than nine inches below the finished deck level so that the deck can be used as a handhold.
- (l) Where flooded suction on the pump is not possible to prevent cavitation and loss of prime, skimmers shall have a device or other protection to prevent air entrainment in the suction line. The inlet to the equalizer line shall be provided with a grate.
- (m) Nothing in this Section shall preclude the use of a roll-out or deck-level type of swimming pool. Such designs shall conform to the general provisions relating to surface overflow systems.
- (n) Nothing in this Section shall preclude the use of a surface overflow system that combines both a perimeter overflow system and a recessed automatic surface skimmer or skimmers.

*History Note: Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. May 1, 2010; February 1, 2004; April 1, 1999; January 1, 1996; July 1, 1992.*

### **15A NCAC 18A .2519 FILTERS**

- (a) All swimming pools shall be equipped with a filtration system for the purpose of clarifying the swimming pool water; said filtration system shall be an integral part of the circulation system and shall consist of one or more units of sand type filters, of diatomaceous earth type filters, or of cartridge type filters.
- (b) All filter units shall be designed and constructed in accordance with Section 5 of the National Sanitation Foundation's Standard number 50 which is hereby adopted by reference in accordance with G.S. 150B-14(c), or equivalent.
- (c) When a sand type filter is installed on a swimming pool, it may be either a gravity or a pressure sand type filter, and it may be either a standard-rate sand type filter which shall be designed for filtration rates not in excess of three gallons per minute per square foot (122 L per minute per square meter) of sand bed area, or a high-rate sand type filter which shall be designed for filtration rates not in excess of 15 gallons per minute per square foot (612 L per

minute per square meter) of sand bed area or the flow rate indicated for commercial pools in the most recent NSF listing.

(d) When a sand type filter is installed on a swimming pool, it shall be designed and installed such that it may be backwashed at a rate recommended by the manufacturer or, in the absence of manufacturer's recommendations, at a rate not less than 15 gallons per minute per square foot (612 L per minute per square meter) of filter bed area. The backwash water shall be discharged to waste. A sight glass or other means for viewing the clarity of the backwash water shall be provided.

(e) If the sand type filter is designed to be operated in conjunction with a coagulant, a chemical feeder shall be provided for adding the coagulant ahead of the filters.

(f) When a diatomaceous earth type filter is installed on a swimming pool, it may be either a pressure or vacuum type and it may be designed to operate either with or without continuous body feed. Diatomaceous earth filters which operate with continuous body feed shall be designed for filtration rates not in excess of 2.5 gallons per minute per square foot (102 L per minute per square meter) of filter area; and diatomaceous earth filters which operate without continuous body feed shall be designed for filtration rates not in excess of two gallons per minute per square foot (82 L per minute per square meter) of filter area.

(g) When a diatomaceous earth type filter is installed on a swimming pool, it shall be designed and installed with provisions for cleaning by one or more of the following methods:

- (1) backwashing at two gallons per minute per square foot minimum;
- (2) air-bump-assist backwashing;
- (3) spray wash, (either mechanical or manual); or
- (4) agitation.

(h) The water used in cleaning a diatomaceous earth type filter shall be discharged to waste, or in a manner approved by the Department.

(i) When a cartridge type filter is installed on a swimming pool, it shall be designed for filtration rates not in excess of 0.375 gallons per minute per square foot (15 L per minute per square meter) of effective filtration area.

(j) When a cartridge type filter is installed on a swimming pool, it shall be designed and installed with provisions being provided for cleaning or replacement as recommended by the manufacturer. Two sets of filter cartridges shall be provided to facilitate the cleaning and drying of one set while the filter is operating.

(k) All filters on swimming pools shall be designed and installed so as to provide easy accessibility for cleaning, operating, maintaining, and servicing. All filter tanks shall be so positioned as to provide adequate circulation of air beneath and around all sides, when necessary, to reduce corrosion and to facilitate cleaning. Whenever filter tanks are installed in the ground (i.e. buried), provisions shall be made so that the tanks are protected against corrosion and are installed in accordance with the recommendations of the manufacturer.

(l) Filters on swimming pools shall be equipped with an approved type pressure gauge or gauges.

(m) Filters on swimming pools shall be designed and installed with all the necessary valves and piping which may be needed to drain the filters completely.

(n) All pressure filters on swimming pools shall be designed and installed with an air-relief valve or valves which shall be located at or near the high point of the filters.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. January 1, 1996.

#### **15A NCAC 18A .2520 CHEMICAL FEEDERS**

*History Note:* Authority G.S. 130A--82;  
Eff. May 1, 1991;  
Repealed Eff. July 1, 1992.

#### **15A NCAC 18A .2521 LADDERS, RECESSED STEPS, AND STAIRS**

(a) If the vertical distance from the bottom of the swimming pool to the deck is over two feet (0.61 m), recessed steps, stairs, or ladders shall be provided in the shallow area of all swimming pools. Recessed steps or ladders shall be provided at the deep portion of all pools; and, if the swimming pool is over 30 feet (9.14 m) wide, such recessed steps or ladders shall be installed on each side near the deep end. A stairway, ladder or set of recessed steps shall be

provided every 75 feet along the shallow area perimeter. Where stairs are provided in the shallow area of the pool, one ladder may be deleted in the shallow area for each stairway provided.

(b) Pool Stairs - The design and construction of pool ladders and stairs shall conform to the following:

- (1) Stair treads shall have a minimum unobstructed horizontal depth of 10 inches, a maximum horizontal depth of 36 inches, and a minimum unobstructed surface area of 240 square inches.
- (2) Risers at the centerline of the treads shall have a maximum height of 12 inches and shall be within one inch of a uniform height with the bottom riser height allowed to vary plus or minus two inches from the uniform riser height.
- (3) Each set of stairs shall be provided with at least one handrail to serve all treads and risers. For stairs wider than 20 feet, additional handrails shall be provided and spaced no more than 10 feet from adjacent handrails or stair ends.
  - (A) Handrails, if removable, shall be installed in such a way that they cannot be removed without the use of tools.
  - (B) The leading edge of handrails facilitating stairs and pool entry/exit shall be no more than 18 inches horizontally from the vertical plane of the bottom riser.
  - (C) The outside diameter of handrails shall be between one inch and one and nine-tenths inches.
- (4) The leading edge of stair treads shall be marked with a contrasting color band or line at least two inches (5 cm) wide visible from above the stairs. Use of contrasting color tiles installed in the stair tread is acceptable provided the tiles are spaced no more than one inch (2.5 cm) from the edge of the tread or from adjacent tiles.
- (5) Swimming pool ladders shall be corrosion-resistant and shall be equipped with slip-resistant treads. All ladders shall be designed to provide a handhold and shall be installed rigidly. There shall be a clearance of not more than six inches (15.3 cm), nor less than three inches (7.6 cm), between any ladder and the swimming pool wall. If the steps are inserted in the walls or if step holes are provided, they shall be of such design that they may be cleaned easily and shall be arranged to drain into the swimming pool to prevent the accumulation of dirt thereon. Step holes shall have a minimum tread of five inches (12.7 cm) and a minimum width of 14 inches (35.6 cm).
- (6) When step holes or ladders are provided within the swimming pool, there shall be a handrail at each side.

*History Note: Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. May 1, 2010; January 1, 1996.*

#### **15A NCAC 18A .2522 DECKS**

- (a) Outdoor swimming pools shall have a continuous deck extending completely around the swimming pool. The width of the deck or walkway shall provide at least six feet of clear walking space at all points. If the swimming area of the pool is 1600 square feet or larger, at least eight feet of clear walking space is required.
- (b) Indoor swimming pools shall have a continuous deck or walkway extending completely around the swimming pool. The width of the deck shall provide at least five feet of clear walking space at all points. Structures covering swimming pools, including temporary domes, shall be constructed to maintain a vertical clearance of at least seven feet from all parts of the required clear walk space.
- (c) Wading pools shall have a continuous deck extending completely around the wading pool. The width of the deck or walkway shall provide at least four feet of clear walking space at all points.
- (d) Spas shall have a continuous deck extending at least one-half way around the spa. The width of the deck or walkway shall provide at least four feet of clear walking space at all points.
- (e) There shall be at least five feet of clear walking space around any diving board, handrail, slide or other permanent structure installed on a swimming pool deck.
- (f) All deck areas and walkways shall be sloped at a grade of one-fourth inch to one-half inch per foot to a deck drain or sheet drain to deck edge. Deck drains shall not be connected to the circulation system in any manner.
- (g) All decks and walkways shall have a slip-resistant, impervious surface.
- (h) Sufficient hose bibs shall be provided to allow all areas of the deck to be reached with a 100 foot hose.
- (i) Special purpose pools such as waterslides and wave pools may vary from the minimum deck area requirements to the extent necessary to accommodate the special features of the pool.

- (j) Structures necessary to provide access to a public swimming pool by persons with disabilities shall be allowed to vary from the provisions of this Section to the extent necessary to accommodate such access. Such structures shall be approved on a case-by-case basis and shall be designed so as to minimize obstruction of the deck.
- (k) For all swimming pools constructed after April 1, 2000 decks shall be continuous with the top of the pool wall or gutter and shall not be more than nine inches above the standard operating water level.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. February 1, 2004; April 1, 1999; January 1, 1996; July 1, 1992.

#### **15A NCAC 18A .2523 DEPTH MARKINGS AND SAFETY ROPES**

- (a) On swimming pools the depth of the water shall be marked at or above the water surface on the vertical wall of the swimming pool where possible and on the edge of the deck next to the swimming pool. Where depth markers cannot be placed on the vertical walls at or above the water level, other means shall be used; provided the markings shall be visible to persons in the swimming pool. Depth markers shall be placed at the following locations:
- (1) at the points of maximum and minimum depths;
  - (2) at the transition point where the slope of the bottom changes from the uniform slope of the shallow area;
  - (3) if the pool is designed for diving, at points to denote the water depths in the diving area; and
  - (4) at both ends of the pool.
- (b) Depth markers shall be so spaced that the distance between adjacent markers is not greater than 25 feet (7.5 m) when measured along the perimeter of the pool.
- (c) Depth markers shall be in Arabic numerals at least four inches (10 cm) high and of a color contrasting with the background. Depth markings shall indicate the depth of the pool in feet of water and shall include the word "feet" or symbol "ft" to indicate the unit of measurement. Depth markings installed in pool decks shall provide a slip resistant walking surface.
- (d) "No Diving" markers shall be provided on the pool deck adjacent to all areas of the pool less than five feet deep. "No Diving" markers shall consist of the words "No Diving" in letters at least four inches high and of a color contrasting with the background or at least a six-by-six inch international symbol for no diving in red and black on a white background. The distance between adjacent markers shall not be more than 25 feet. Posting of "No Diving" markers shall not preclude shallow diving for racing starts and competitive swimming practice.
- (e) A minimum of  $\frac{3}{4}$  inch diameter safety rope shall be provided at the breakpoint where the slope of the bottom changes to exceed a 1 to 10 vertical rise to horizontal distance at a water depth of five feet (1.5 m) or less. The position of the rope shall be marked with colored floats at not greater than a five-foot spacing and a minimum two inch wide contrasting color band across the pool bottom. Float ropes shall be positioned within two feet on the shallow side of the breakpoint marker.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. May 1, 2010; February 1, 2004; January 1, 1996; July 1, 1992.

#### **15A NCAC 18A .2524 LIGHTING AND VENTILATION**

- (a) Artificial lighting shall be provided at all pools that are to be used at night, or when natural lighting is insufficient to provide visibility in the pool area.
- (b) Lighting fixtures shall be of such number and design as to illuminate all parts of the pool, the water, the depth markers, signs, entrances, restrooms, safety equipment and the required deck area and walkways.
- (c) Fixtures shall be installed so as not to create hazards such as burning, electrical shock, mechanical injury, or temporary blinding by glare to the bathers, and so that lifeguards, when provided, can see every part of the pool area without being blinded by glare. The illumination shall be sufficient so that the floor of the pool can be seen at all times the pool is in use.
- (d) If underwater lighting is used, it shall provide at least 0.5 watts or 8.35 lumens per square foot of water surface and deck lighting shall provide not less than 10 foot candles of light measured at 6 inches above the deck surface.
- (e) Where underwater lighting is not used, and night swimming is permitted, area and pool lighting combined shall provide not less than 10 foot candles of light to all parts of the pool and required deck area.
- (f) Mechanical ventilation is required for all indoor pools.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. May 1, 2010; February 1, 2004; January 1, 1996; July 1, 1992.

#### **15A NCAC 18A .2525 HEATER AND TEMPERATURE REQUIREMENTS**

- (a) Pool heaters shall be designed for the purpose intended.
- (b) Heaters shall be equipped with thermostatic controls capable of assuring that the maximum operating temperature of spa water does not exceed 104 degrees Fahrenheit (40 degrees C), and that the maximum operating temperature of other heated public swimming pools does not exceed 90 degrees Fahrenheit (32 degrees C). Such controls shall be accessible only to the operator.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. February 1, 2004; August 1, 1991.

#### **15A NCAC 18A .2526 DRESSING AND SANITARY FACILITIES**

- (a) Dressing and sanitary facilities shall be provided at all pools, except for pools at hotels, motels, condominiums, and apartments where pool use is restricted to residents or guests. At hotels, motels, condominiums and apartments where the farthest unit is more than 300 feet from the pool, as measured along walkways provided for access by residents or guests to the pool area, a toilet and lavatory shall be provided. All public swimming pools shall post a sign visible upon entering the pool enclosure directing pool users to shower before entering the pool.
- (b) Partitions shall be of material, not subject to damage by water and shall be designed so that a waterway is provided between partitions and floor to permit thorough cleaning of the walls and floor areas with hoses and brooms.
- (c) Dressing facility floors shall be continuous throughout the areas. Floors shall have a slip-resistant surface that shall be smooth, to insure complete cleaning. Floor drains shall be provided, and floors shall be sloped not less than ¼ inch per foot toward the drains to insure positive drainage.
- (d) Hose bibs shall be provided such that all parts of the dressing facility interior can be reached with a 50 foot hose.
- (e) The minimum number of fixtures required in dressing and sanitary facilities shall be based upon the maximum bather load.
- (f) One water closet, one lavatory, and one urinal shall be provided for the first 100 male users. One additional water closet, lavatory, and urinal shall be provided for each additional 200 male users up to a total of 500 users. Where user load exceeds 500 male users, two additional water closets or urinals and one lavatory shall be provided for each additional 250 male users. Where the maximum bather load includes less than 50 male users, one water closet and one lavatory will be sufficient.
- (g) Two water closets and two lavatories shall be provided for the first 100 female users. One additional water closet and lavatory shall be provided for each additional 100 female users up to a total of 500 users. Where user load exceeds 500 female users, two additional water closets and one lavatory shall be provided for each additional 250 female users. Where the maximum bather load includes less than 50 female users, one water closet and one lavatory will be sufficient.
- (h) Showers shall be provided in the proportion of one for each 200 persons at the time of maximum bather load.
- (i) The water heater shall be inaccessible to users. The system shall be designed such that water temperature at the shower heads and lavatories cannot exceed 110° Fahrenheit.
- (j) Soap dispensers with either liquid or powdered soap shall be provided at each lavatory or required shower. The dispenser shall be of all metal or plastic type, with no glass permitted in these units.
- (k) If mirrors are provided, they shall be of shatterproof materials.
- (l) Toilet paper holders with toilet paper shall be provided at each water closet.
- (m) Dressing and sanitary facilities shall be kept clean and in good repair.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. February 1, 2004; April 1, 1999; January 1, 1996; July 1, 1992.

#### **15A NCAC 18A .2527 SWIMMING POOL SLIDES**

All swimming pool slides installed at a public swimming pool shall be labeled by the manufacturer for use in public pools, and shall be installed in accordance with manufacturer's instructions.

*History Note: Authority G.S. 130A-282;  
Eff. May 1, 1991.*

#### **15A NCAC 18A .2528 FENCES**

(a) Public Swimming pools shall be completely enclosed by a fence, wall, building, or other enclosure, or any combination thereof, which encloses the swimming pool area such that all of the following conditions are met:

- (1) The top of the barrier shall be at least 48 inches above grade measured on the side of the barrier that faces away from the swimming pool. The maximum vertical clearance between grade and the bottom of the barrier shall be two inches measured on the side of the barrier that faces away from the swimming pool;
- (2) Openings in the barrier shall not allow passage of a four-inch-diameter sphere and shall provide no external handholds or footholds. Solid barriers that do not have openings shall not contain indentations or protrusions except for normal construction tolerances and tooled masonry joints;
- (3) Where the barrier is composed of horizontal and vertical members and the distance between the tops of the horizontal members is 45 inches or more, spacing between the vertical members shall not exceed four inches. Where there are decorative cutouts within the vertical members, spacing within the cutouts shall not exceed 1.75 inches in width;
- (4) Where the barrier is composed of horizontal and vertical members and the distance between the tops of the horizontal members is less than 45 inches, the horizontal members shall be located on the swimming pool side of the fence. Spacing between the vertical members shall not exceed 1.75 inches in width. Where there are decorative cutouts within the vertical members, spacing within the cutouts shall not exceed 1.75 inches in width;
- (5) Maximum mesh size for chain link fences shall be a 2.25 inch square unless the fence is provided with slats fastened at the top or the bottom that reduce the openings to no more than 1.75 inches;
- (6) Where the barrier is composed of diagonal members, the maximum opening formed by the diagonal members shall be no more than 1.75 inches;
- (7) Access gates shall comply with the dimensional requirements for fences and shall be equipped to accommodate a locking device. Effective April 1, 2011, pedestrian access gates shall open outward away from the pool and shall be self-closing and have a self-latching device except where a gate attendant and lifeguard are on duty. Gates other than pedestrian access gates shall have a self-latching device. Where the release mechanism of the self-latching device is located less than 54 inches from the bottom of the gate, the release mechanism shall require the use of a key, combination or card reader to open or shall be located on the pool side of the gate at least three inches below the top of the gate, and the gate and barrier shall have no openings greater than 0.5 inch within 18 inches of the release mechanism; and
- (8) Ground level doors and windows opening from occupied buildings to inside the pool enclosure shall be self-closing or child protected by means of a barrier or audible alarm.

(b) Public swimming pool fences constructed prior to May 1, 2010 may vary from the provisions of Paragraph (a) of this Rule as follows:

- (1) the maximum vertical clearance between grade and the bottom of the barrier may exceed two inches, but shall not exceed four inches;
- (2) where the barrier is composed of vertical and horizontal members and the space between vertical members exceeds 1.75 inches, the distance between the tops of the bottom horizontal member and the next higher horizontal member may be less than 45 inches, but shall not be less than 30 inches;
- (3) gates other than pedestrian access gates are not required to have self-latching devices if the gates are kept locked; and
- (4) gates may swing towards a pool where natural topography, landscape position or emergency egress requirements prevent gates from swinging away from the pool.

*History Note: Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. May 1, 2010; February 1, 2004; April 1, 1999; January 1, 1996; July 1, 1992.*

**15A NCAC 18A .2529 USER LOADING**

In determining the maximum number of persons allowed in the pool at any one time, the following criteria shall govern:

- (1) Fifteen square feet (1.39 sq m) of water surface area per person shall be provided in areas of the pool five feet (1.52 m) deep or less.
- (2) Twenty-four square feet (2.23 sq m) of water surface area per person shall be provided in areas of the pool greater than five feet (1.52 m) deep. Three hundred square feet (27.87 sq m) of pool area around each diving board or platform, where provided, shall not be included in computing this area for the purpose of determining maximum bather load.
- (3) Ten square feet (0.9 sq m) of water surface area per person shall be provided in spas.
- (4) Twenty-five square feet of splash zone area per person shall be provided at interactive play attractions.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. March 1, 2004; January 1, 1996.

**15A NCAC 18A .2530 SAFETY PROVISIONS**

(a) Swimming pools shall have lifesaving equipment conspicuously and conveniently on hand at all times. A unit of lifesaving equipment shall include the following:

- (1) A pole not less than 12 feet long, with a body hook securely attached. The pole attached to the body hook shall be non-telescoping, non-adjustable and non-collapsible.
- (2) A minimum ¼ inch diameter throwing rope as long as one and one-half times the maximum width of the pool or 50 feet, whichever is less, attached to a U.S. Coast Guard approved ring buoy. A rescue tube or rescue can shall be accepted as a substitute for the ring buoy where it is accompanied by a lifeguard who has been trained to use it properly.

(b) Two units of lifesaving equipment must be provided for any pool that exceeds 3,000 square feet (186 sq m) of total surface area.

(c) When a swimming pool does not have at least one lifeguard on duty, a sign shall be posted with legible letters of at least four inches (10 cm) in height stating: "WARNING-NO LIFEGUARD ON DUTY." In addition there shall be signs legible from all bather entrances with a minimum letter size of one inch stating: "CHILDREN SHOULD NOT USE THE SWIMMING POOL WITHOUT ADULT SUPERVISION", and: "ADULTS SHOULD NOT SWIM ALONE". Wading pools that do not have a lifeguard inside the wading pool enclosure shall have a sign posted stating "WARNING NO LIFEGUARD ON DUTY". Such signs shall be mounted permanently.

(d) A sign prohibiting pets and glass containers in the pool area shall be provided.

(e) Pool closed signs shall be provided and shall be posted at bather entrances whenever an operation permit is suspended for water quality or safety violations.

(f) A telephone capable of directly dialing 911 or other emergency notification system shall be provided and accessible to all pool users. Effective April 1, 2005 the telephone shall be permanently affixed to a location inside the pool enclosure or outside the enclosure within 75 feet of a bather entrance. The telephone shall be visible from within the pool enclosure or a sign shall be posted indicating the location of the emergency telephone. A sign with legible letters shall be posted at the telephone providing dialing instructions, address of the pool location and the telephone number. Where the telephone does not directly access 911, the emergency notification system shall:

- (1) Provide 24 hour monitoring of all incoming calls by a telecommunicator who answers only emergency calls;
- (2) Be capable of routing calls to the local 911 telecommunicator via the 911 dedicated emergency trunk line; and
- (3) Electronically transfer Automatic Number Identification and Automatic Locator Identification for the emergency telephone at the pool to the Enhanced 911 system for all calls routed to 911.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. February 1, 2004; April 1, 1999; January 1, 1996; July 1, 1992.

**15A NCAC 18A .2531 WADING POOLS**

(a) Wading pools shall meet all design specifications for swimming pools and wading pools included in Rules .2512 through .2530 of this Section with the following exceptions:

- (1) Wading pools shall be physically separate from other public swimming pools except that a fill pipe and valve from a swimming pool recirculation system may be used to introduce water to a wading pool.
- (2) Every wading pool shall be equipped with a circulation system that is separate from, and independent of, the circulation system of the swimming pool. Such circulation system shall at least consist of a circulating pump, piping, a filter, a rate-of-flow meter, a disinfectant feeder, two inlets, and one automatic surface skimmer. Individual components of a wading pool system must meet the criteria of Rule .2518 of this Section.
- (3) The capacity of the circulation system shall be capable of filtering and disinfecting the entire volume of water in the wading pool 12 times in every 24 hours.
- (4) Wading pools shall be equipped with a surface overflow system capable of removing floating material.
- (5) Wading pools shall be no deeper than 24 inches (61 cm) at the deepest point.
- (6) Wading pools' floor slope shall not exceed one foot in 12 feet.
- (7) Wading pools shall be located in the vicinity of the shallow end of the swimming pool, and shall be separated from the swimming pool by a fence or structure similar to that described in Rule .2528 of this Section, that shall be equipped with self-closing and positive self-latching closure mechanisms, and shall be equipped with permanent locking devices. Wading pool entrance gates located inside another public swimming pool enclosure shall open away from the deeper pool. Wading pool fences constructed after April 1, 2000 shall be at least four feet high.
- (8) Wading pools shall be designed to provide at least 10 square feet per child.
- (9) Depth markers are not required at wading pools.
- (10) The free chlorine residual in wading pools shall be maintained at no less than two parts per million.
- (11) Wading pools are not required to provide the lifesaving equipment described in Rule .2530(a) of this Section.

(b) Children's activity pools shall be constructed and operated in accordance with the rules of this Section including the requirements for wading pools with the following exceptions:

- (1) The filter circulation system shall be separate from any feature pump circulation system.
- (2) The filter circulation system for stand-alone children's activity pools shall filter and return the entire water capacity in no more than one hour and shall operate 24 hours a day.
- (3) The disinfectant residual in children's activity pools shall be maintained at a level of at least two parts per million of free chlorine measured in the pool water and at least one part per million in all water features.
- (4) Valves shall be provided to control water flow to the features in accordance with the manufacturers' specifications.
- (5) Children's activity pools built prior to February 1, 2004 that do not comply with this Paragraph may operate as built if no water quality or safety violations occur.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. May 1, 2010; February 1, 2004; April 1, 1999; January 1, 1996.

#### **15A NCAC 18A .2532 SPAS AND HOT TUBS**

Spas and hot tubs shall meet all design specifications for swimming pools and wading pools included in Rules .2512 through .2530 of this Section with the following exceptions:

- (1) The circulation system equipment shall provide a turnover rate for the entire water capacity at least once every 30 minutes.
- (2) The arrangement of water inlets and outlets shall produce a uniform circulation of water so as to maintain a uniform disinfectant residual throughout the spa.
- (3) A minimum of two inlets shall be provided with inlets added as necessary to maintain required flowrate.
- (4) Water outlets shall be designed so that each pumping system in the spa (filter systems or booster systems if so equipped) provides the following:

- (a) Where drains are provided, drains shall be unblockable or shall consist of two or more drains connected by a "T" pipe. Connecting piping shall be of the same diameter as the main drain outlet. Filter system drains shall be capable of emptying the spa completely. In spas constructed after April 1, 2000 drains shall be installed at least three feet apart or located on two different planes of the pool structure.
  - (b) Filtration systems shall provide at least one surface skimmer per 100 square feet, or fraction thereof of surface area.
- (5) The water velocity in spa or hot tub discharge piping shall not exceed 10 feet per second (3.05 meters per second); except for copper pipe where water velocity shall not exceed eight feet per second (2.44 meters per second). Suction water velocity in any piping shall not exceed six feet per second (1.83 meters per second).
- (6) Spa recirculation systems shall be separate from companion swimming pools.
  - (a) Where a two-pump system is used, one pump shall provide the required turnover rate, filtration and disinfection for the spa water. The other pump shall provide water or air for hydrotherapy turbulence without interfering with the operation of the recirculation system. The timer switch shall activate only the hydrotherapy pump.
  - (b) Where a single two-speed pump is used, the pump shall be designed and installed to provide the required turnover rate for filtration and disinfection of the spa water at all times without exceeding the maximum filtration rates specified in Rule .2519 of this Section. The timer switch shall activate only the hydrotherapy portion of the pump.
  - (c) Where a single one-speed pump is used, a timer switch shall not be provided.
- (7) A timer switch shall be provided for the hydrotherapy turbulence system with a maximum of 15 minutes on the timer. The switch shall be placed such that a bather must leave the spa to reach the switch.
- (8) The maximum operational water depth shall be four feet (1.22 m) measured from the water line.
- (9) The maximum depth of any seat or sitting bench shall be two feet (61 centimeters) measured from the waterline.
- (10) A minimum height between the top of the spa/hot tub rim and the ceiling shall be seven and a half feet.
- (11) Depth markers are not required at spas.
- (12) Steps, step-seats, ladders or recessed treads shall be provided where spa and hot tub depths are greater than 24 inches (61 centimeters).
- (13) Contrasting color bands or lines shall be used to indicate the leading edge of step treads, seats, and benches.
- (14) A spa or hot tub shall be equipped with at least one handrail (or ladder equivalent) for each 50 feet (15.2 meters) of perimeter, or portion thereof, to designate points of entry and exit.
- (15) Where water temperature exceeds 90 degrees Fahrenheit (32 degrees Celsius), a caution sign shall be mounted adjacent to the entrance to the spa or hot tub. It shall contain the following warnings in letters at least ½ inch in height:

CAUTION:

  - Pregnant women; elderly persons, and persons suffering from heart disease, diabetes, or high or low blood pressure should not enter the spa/hot tub without prior medical consultation and permission from their doctor;
  - Do not use the spa/hot tub while under the influence of alcohol, tranquilizers, or other drugs that cause drowsiness or that raise or lower blood pressure;
  - Do not use alone;
  - Unsupervised use by children is prohibited;
  - Enter and exit slowly;
  - Observe reasonable time limits (that is, 10-15 minutes), then leave the water and cool down before returning for another brief stay;
  - Long exposure may result in nausea, dizziness, or fainting;
  - Keep all breakable objects out of the area.
- (16) Spas shall meet the emergency telephone and signage requirements for swimming pools in Rule .2530(f).
- (17) A sign shall be posted requiring a shower for each user prior to entering the spa or hot tub and prohibiting oils, body lotion, and minerals in the water.

- (18) Spas are not required to provide the lifesaving equipment described in Rule .2530(a) of this Section.
- (19) In spas less than four feet deep, the slope of the pool wall may exceed 11 degrees from plumb, but shall not exceed 15 degrees from plumb.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. May 1, 2010; January 1, 2006; July 1, 2004; February 1, 2004; April 1, 1999;  
January 1, 1996; July 1, 1992.

#### **15A NCAC 18A .2533 EQUIPMENT ROOM**

- (a) All pumps, chemical feeding apparatus and other mechanical and electrical equipment shall be enclosed in a weatherproof structure with a minimum ceiling height of seven feet. The equipment room shall be provided with a door with a permanent lock that must be kept locked when not in use by the pool operator. Filters located outside the equipment room shall be completely enclosed by a fence.
- (b) Lighting to allow the operator to read all gauges and control devices shall be provided.
- (c) Valves and control devices shall be accessible and visible to the pool operator. At least three feet of clear walkway shall be provided to allow access to equipment.
- (d) Drainage in and around the equipment room shall preclude the possibility of water entering or accumulating on any interior surface of the enclosure. Equipment room floors shall be sloped not less than ¼ inch per foot toward the drains.
- (e) Natural cross draft or continuous forced ventilation is required.
- (f) A permanent means of access shall be provided to all equipment rooms.
- (g) A hose bib with an approved backflow prevention device shall be provided within 50 feet of the equipment room.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. February 1, 2004; January 1, 1996.

#### **15A NCAC 18A .2534 CHEMICAL STORAGE ROOM**

A separate chemical storage room that meets the following criteria shall be provided:

- (1) The chemical storage room shall be in a dry, weatherproof structure with a minimum ceiling height of seven feet.
- (2) For public swimming pools built after May 1, 1996, chemical storage space shall be provided based on a minimum of five square feet for the first 10,000 gallons of pool water plus one additional square foot for each additional 3,000 gallons or portion thereof up to a total area of 100 square feet. Public swimming pools constructed after April 1, 2004 shall provide a separate room for storage of pool chemicals.
- (3) Natural cross draft or continuous forced ventilation is required.
- (4) Provision shall be made for dry storage of all pool chemicals in waterproof containers or above the floor on shelves, pallets or dollies.
- (5) The chemical storage room shall be arranged so that chemicals which can react with other pool chemicals are stored separately and shall be constructed and arranged to permit easy cleanup of chemical spills.
- (6) Lighting shall be provided in chemical storage rooms.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. February 1, 2004; January 1, 1996.

#### **15A NCAC 18A .2535 WATER QUALITY STANDARDS**

Whenever a public swimming pool is open for use, water quality shall be maintained in accordance with the following:

- (1) The chemical quality of the water shall be maintained in an alkaline condition at all times with the pH between 7.2 and 7.8.

- (2) The clarity of the water shall be maintained such that the main drain grate is visible from the pool deck at all times.
- (3) Disinfection shall be provided in accordance with manufacturers' instructions for all pools by a chemical or other process that meets the criteria listed as follows:
  - (a) registered with the U.S. Environmental Protection Agency for pool water or potable water;
  - (b) provides a residual effect in the pool water that can be measured by portable field test equipment;
  - (c) will not impart any immediate or cumulative adverse physiological effects to pool bathers when used as directed;
  - (d) will not produce any safety hazard when stored or used as directed;
  - (e) will not damage pool components or equipment; and
  - (f) will demonstrate reduction of total coliform and fecal coliform to a level at least equivalent to free chlorine at a level of one part per million in the same body of water.
- (4) When chlorine is used as the disinfectant, a free chlorine residual of at least one part per million (ppm) shall be maintained throughout the pool whenever it is open or in use. Pools that use chlorine as the disinfectant must be stabilized with cyanuric acid except at indoor pools or where it can be shown that cyanuric acid is not necessary to maintain a stable free chlorine residual. The cyanuric acid level shall not exceed 100 parts per million.
- (5) When bromine or compounds of bromine are used as the disinfectant, a free bromine residual of at least two parts per million, shall be maintained throughout the pool whenever it is open or in use.
- (6) When chlorine or bromine are used as the disinfectant, automatic chemical feeders shall be used. Automatic chlorine or bromine feeders shall be manufactured and installed in accordance with NSF/ANSI Standard number 50. Automatic chlorine and bromine feeder pumps shall be automatically prevented from operating when the circulation pump is not in operation.
- (7) When biguanide is used as the disinfectant, a residual of 30 to 50 parts per million shall be maintained throughout the pool whenever it is open or in use.
- (8) When silver/copper ion systems are used, the copper concentration in the pool water shall not exceed one part per million and a chlorine residual must be maintained in accordance with Item (4) of this Rule.
- (9) The use of chlorine in its elemental (gaseous) form for disinfection of public swimming pools is prohibited.
- (10) Test kits or equipment capable of measuring disinfectant level, pH, and total alkalinity must be maintained at all public swimming pools. Pools using cyanuric acid or chlorinated isocyanurates must have a test kit capable of measuring cyanuric acid levels.
- (11) The pool operator shall inspect the pool at least daily and maintain written records of the operating conditions of each pool. Records shall be maintained at the pool site for a period of not less than six months. Records shall include the following:
  - (a) daily recording of the disinfectant residual in the pool;
  - (b) daily recording of pool water pH;
  - (c) daily recording of water temperature in heated pools; recording of activities pertaining to pool water maintenance including chemical additions and filter backwash cycles;
  - (d) weekly recording of total alkalinity and cyanuric acid levels; and
  - (e) daily recording of pool drain cover/grate inspection.
- (12) Water temperature in heated swimming pools shall not exceed 90 degrees Fahrenheit (32 degrees Celsius) and in heated spas shall not exceed 104 degrees Fahrenheit (40 degrees Celsius).
- (13) The pool operator shall take the following steps to manage fecal and vomitus accidents:
  - (a) Direct everyone to leave all pools into which water containing the feces or vomit is circulated and do not allow anyone to enter the pool(s) until decontamination is completed;
  - (b) Remove as much of the feces or vomit as possible using a net or scoop and dispose of it in a sewage treatment and disposal system;
  - (c) Raise the free available chlorine concentration to two ppm at a pH of 7.2 to 7.5 and test to assure the chlorine concentration is mixed throughout the pool; and
  - (d) For accidents involving formed stools or vomit, maintain the free available chlorine concentration at two ppm for at least 25 minutes or at three ppm for at least 19 minutes

before reopening the pool. For accidents involving liquid stools increase the free chlorine residual and closure time to reach a CT inactivation value of 15,300 then backwash the pool filter before reopening the pool. CT refers to concentration (C) of free available chlorine in parts per million multiplied by time (T) in minutes.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991;  
Amended Eff. May 1, 2010; February 1, 2004; April 1, 1999; January 1, 1996; July 1, 1992.

#### **15A NCAC 18A .2536 REVOCATION OF PERMITS**

The Department may suspend or revoke permits in accordance with G.S. 130A-23.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1991.

#### **15A NCAC 18A .2537 MAINTENANCE AND OPERATION**

(a) All public swimming pools constructed or remodeled on or after May 1, 1991 shall be maintained and operated in accordance with the Rules of this Section.

(b) On or after May 1, 1993 all public swimming pools including those constructed prior to May 1, 1991 shall be maintained and operated in accordance with the following:

- (1) All safety provisions of Rule .2530 of this Section shall be met.
- (2) Decks shall be structurally sound and shall be maintained free of trip hazards or offsets greater than one-half inch resulting from deterioration or changes from the original deck profile.
- (3) There shall be no loose coping.
- (4) Artificial lighting shall be provided for all pools used when natural lighting is not sufficient to make all parts of the pool and pool area clearly visible.
- (5) Swimming pools shall be protected by a fence, wall, building, or other enclosure, or any combination thereof, that completely encloses the swimming pool area. All gates and doors shall be equipped with self-closing and positive self-latching closure mechanisms. Existing waterslide flumes and other appurtenances are not required to be located inside the fence.
- (6) Depth and safety markings shall be provided as required in Rule .2523 of this Section
- (7) Drain covers shall be in good condition and securely attached.
- (8) Damaged face plates or fittings shall be repaired or replaced.
- (9) Underwater light niches shall be maintained or covered so as not to present a potential hazard to bathers.
- (10) Diving equipment and pool slides including stairs and railing shall be maintained in good working order.
- (11) A timer switch that allows no more than 15 minutes of operation without manual resetting shall be used to control air blowers and hydrotherapy pumps on heated spas.
- (12) All breaks in grade of the pool bottom including the leading edges of stair treads and seats and the tops of breakpoints where the slope of the bottom changes at a depth of five feet (15m) or less shall be marked with a contrasting color band by May 1, 2000. Contrasting color bands are not required where a registered engineer, registered architect or licensed swimming pool contractor certifies in writing that structural weakness or materials of construction prevent the installation of permanent markings.
- (13) All heated spas shall post a caution sign as specified in Rule .2532 of this Section.
- (14) Pool maintenance shall include removal of debris from the water surface and bottom of the pool.
- (15) All pool chemicals shall be stored in a clean, dry, well ventilated area and shall be organized so as to prevent chemicals from reacting.
- (16) No submersible pumps or mechanical pool cleaning equipment shall be placed or used in the pool while bathers are in the pool.

(c) The owner of a public swimming pool shall provide for the operation of the pool by a person or persons who shall be responsible to the owner for operation, maintenance, pool safety and record keeping. The pool owner shall maintain documentation that the person responsible for operating the pool has been trained on pool equipment operation, disease and injury prevention, pool water chemistry and regulatory requirements for public swimming

pools. A pool and spa operator certificate issued by the National Swimming Pool Foundation or other organization that provides training on those subjects shall be accepted as meeting this requirement.

*History Note:* Authority G.S. 130A-282;  
Eff. July 1, 1992;  
Temporary Amendment Eff. May 11, 1993 for a period of 180 days or until the permanent rule becomes effective, whichever is sooner.  
The Codifier of Rules determined that the agency's findings of need did not meet the criteria listed in GS 150B-21.1(a);  
Temporary Amendment Eff. May 1, 1993 for a period of 180 days or until the permanent rule becomes effective, whichever is sooner;  
Amended Eff. February 1, 2004; April 1, 1999; January 1, 1996; October 1, 1993; May 1, 1993.

#### **15A NCAC 18A .2538 FILL AND DRAW POOLS**

Fill and draw pools are prohibited. Provisions shall be made for filtration and recirculation of water in all public swimming pools, wading pools, and spas.

*History Note:* Authority G.S. 130A-282;  
Eff. May 1, 1993.

#### **15A NCAC 18A .2539 SUCTION HAZARD REDUCTION**

(a) At all public wading pools that use a single main drain for circulation of water, signs shall be posted stating, "WARNING: To prevent serious injury do not allow children in wading pool if drain cover is broken or missing." Signs shall be in letters at least one-half inch in height and shall be posted where they are visible to people entering the wading pool.

(b) All submerged suction outlets other than vacuum ports shall be protected by anti-entrapment cover/grates in compliance with ASME/ANSI A112.19.8-2007 Suction Fittings for Use in Swimming Pools, Wading Pools, Spas, and Hot Tubs. All submerged suction fittings shall be installed in accordance with the manufacturer's instructions. Pumping systems that have a single main drain or single submerged suction outlet other than an unblockable drain, or which have multiple outlets separated by less than three feet measured at the centers of the cover grates shall have one or more secondary methods of preventing bather entrapment. Secondary methods of preventing bather entrapment include:

- (1) Safety vacuum release system which ceases operation of the pump, reverses the circulation flow, or otherwise provides a vacuum release at the suction outlet when a blockage has been detected, that has been tested by a third party and found to conform to ASME/ANSI standard A112.19.17 which is incorporated by reference including any subsequent amendments or editions. Copies may be obtained from ASME, P.O. Box 2300, Fairfield, NJ 07007-2300 at a cost of forty-five dollars (\$45.00);
- (2) A suction-limiting vent system with a tamper-resistant atmospheric opening;
- (3) A gravity drainage system that utilizes a collector tank;
- (4) An automatic pump shut-off system;
- (5) Drain disablement; or
- (6) Any other system determined by the U.S. Consumer Product Safety Commission to be equally effective as, or better than the systems in Subparagraphs (1) through (5) of this Paragraph.

(c) Prior to issuance of operation permits, owners of all public swimming pools shall provide documentation to the Department to verify suction outlet safety compliance. This documentation shall include:

- (1) Documentation of the maximum possible flow rate for each pump suction system. This shall be the maximum pump flow shown on the manufacturer's pump performance curve except where flow reductions are justified with total dynamic head measurements or calculations; and
- (2) Documentation that cover/grates meeting ASME/ANSI A112.19.8-2007 are installed in compliance with the standard and manufacturer's instructions. This includes documentation that each cover/grate on a single or double-drain pump suction system is rated to meet or exceed the maximum pump system flow and that cover/grates on a pump suction system with three or more suction outlets are together rated to always meet or exceed the maximum pump system flow with one drain completely blocked; and

- (3) Documentation that drain sumps meet the dimensional requirements specified in the cover/grate manufacturer's installation instructions.
- (d) Operators of all public swimming pools shall inspect pools daily to ensure the drain covers are in good condition and securely attached. Missing, broken, or cracked suction fittings shall be replaced and loose suction fittings shall be reattached before using the pool.

*History Note:* Authority G.S. 130A-282;  
Temporary Adoption Eff. June 1, 1994 for a period of 180 days or until the permanent rule becomes effective, whichever is sooner;  
Eff. October 1, 1994;  
Amended Eff. May 1, 2010; January 1, 2006; February 1, 2004; April 1, 1999.

#### **15A NCAC 18A .2540 REPORTING OF INJURY OR ILLNESS**

The pool operator shall report any death, serious injury or complaint of illness attributed by a bather to use of a public swimming pool to the local health department within two working days of the incident or complaint. The report to the health department shall include the following:

- (1) Name and telephone number or address of the person injured or making a complaint.
- (2) Date of the incident or onset of illness.
- (3) Description of the type of injury or complaint.
- (4) Name and phone number of the person rendering assistance or first aid.
- (5) The name of any known hospital, rescue squad or physician providing medical assistance.
- (6) Names and phone numbers of available witnesses to the incident.

*History Note:* Authority G.S. 130A-282;  
Eff. January 1, 1996.

#### **15A NCAC 18A .2541 FLOW THROUGH POOLS**

Tanks or structures built prior to May 1, 1995 which hold a flowing natural water source for public swimming, diving, wading or recreational use without physical or chemical treatment shall not be required to comply with the rules of this Section.

*History Note:* Authority G.S. 130A-282;  
Eff. January 1, 1996.

#### **15A NCAC 18A .2542 IN POOL EXERCISE EQUIPMENT**

(a) Exercise equipment such as steps, weights, or floats used in a public swimming pool shall be designed and constructed so as not to pose a threat to water quality or bather safety and shall be removed from the pool after each use.

(b) Where in-pool exercise equipment such as underwater treadmills remain in a swimming pool when not in use, the following conditions shall be met:

- (1) The swimming pool shall be restricted to use only by adults or a lifeguard shall be on duty at all times when children are allowed in the pool.
- (2) Exercise equipment shall meet Underwriters' Laboratories Standard Number 1647 for exercise equipment as verified in writing by an independent third party testing laboratory.
- (3) The position of underwater equipment shall be marked with colored floats attached by a 3/4 inch diameter rope or other movable barrier that surrounds the equipment with a visible perimeter designed so as not to entangle or otherwise threaten bather safety.
- (4) Equipment shall be verified by the manufacturer to be designed for use in a public swimming pool and to be free of grease or oil that might negatively impact pool water quality.
- (5) Any cords or hoses attached to underwater exercise equipment shall not pose a threat of bather entanglement. Cords or hoses which cross a pool deck shall be covered or shielded to prevent tripping. Covers that protrude more than one-half inch from the deck surface shall be sloped at an angle of no more than 30° from the horizontal deck surface.

*History Note:* Authority G.S. 130A-282;

*Eff. January 1, 1996;  
Amended Eff. February 1, 2004.*

### **15A NCAC 18A .2543 WATER RECREATION ATTRACTIONS**

(a) Water recreation attractions including water slides, wave pools, rapid rides, lazy rivers and other similar features can deviate from the requirements of this Section with respect to pool profile, depth, freeboard, flow dynamics and surface skimming systems. The designing engineer or equipment manufacturer shall provide the Department with information to justify such deviation as necessary for the proper function of the attraction. Water recreation attractions shall meet all other requirements of this Section.

(b) Water slide landing pools with a capacity of less than 60,000 gallons shall have a circulation and filtration system capable of turning over the entire pool capacity every two hours. Where automatic chemical controllers are used the turnover time shall be no more than three hours. Landing pool dimensions shall be consistent with the slide manufacturer's recommendation.

(c) When waterfalls are incorporated in water recreation attractions, they shall be constructed with no handholds or footholds to a height of four feet to discourage climbing.

(d) Interactive play attractions shall be constructed and operated in accordance with the rules of this section and shall comply with the following:

- (1) The recirculation system shall contain a water capacity equal to at least three minutes of maximum flow of all feature pumps and filter circulation pumps combined and shall not be less than 1,000 gallons. Where the water capacity exceeds 10,000 gallons, the minimum capacity shall be based on the lesser of three minutes of maximum feature flow or 7.5 gallons per square foot of splash zone watershed drained to the surge container.
- (2) Access shall be provided to the surge water container.
- (3) A filter circulation system shall be provided and shall be separate from the feature pump system except that both systems can draw water from a common drain pipe if the drain and pipe are sized to handle the flow of all pumps without exceeding the flow velocities specified in Rule .2518 of this Section.
- (4) The filter circulation system shall draw water from the surge container through a variable height surface skimmer and a bottom drain located no more than 6 inches from the bottom of the container. Custom skimming systems that do not comply with ANSI/NSF Standard 50 shall be approved where the operational requirements make it necessary to deviate from that standard.
- (5) The filter circulation system shall filter and return the entire water capacity in no more than 30 minutes and shall operate 24 hours a day.
- (6) Automatic chemical controllers shall be provided to monitor and adjust the disinfectant residual and pH of the water contained in the system.
- (7) The disinfectant residual in interactive play attractions shall be maintained at a level of at least two parts per million of free chlorine. Chlorine feeders shall be capable of producing 12 parts per million of free chlorine in the filter circulation piping.
- (8) Valves shall be provided to control water flow to the features in accordance with the manufacturers' specifications.
- (9) Splash zones shall be sloped to drains sized and located to remove all feature water to the surge tank without water accumulating on the surface.
- (10) Deck or walkway space is not required outside the splash zone.
- (11) Dressing and sanitary facilities shall be provided.
- (12) Interactive play features shall not be required to have a fence except the wading pool fence requirements shall apply to interactive play features located inside a swimming pool enclosure.
- (13) The safety provisions of Rule .2530 of this Section shall not apply except a sign shall be posted prohibiting pets and glass containers.
- (14) Interactive play attractions built prior to April 1, 2004, that do not comply with these design and construction requirements shall be permitted to operate as built if no water quality or safety violations occur.

(e) Training pools shall meet the requirements for swimming pools with the following exceptions:

- (1) Training pools shall be equipped with a filter circulation system that filters and returns the entire pool capacity in no more than two hours.
- (2) The free chlorine residual in training pools shall be maintained at no less than two parts per million.

*History Note: Authority G.S. 130A-282;  
Eff. April 1, 1999;  
Amended Eff. March 1, 2004.*

Regulations  
Governing  
Swimming Pools  
in  
Durham County

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DURHAM COUNTY  
BOARD OF HEALTH  
REGULATIONS GOVERNING  
SWIMMING POOLS IN  
DURHAM COUNTY

Whereas, there are approximately 205 public swimming pools in Durham County, and

Whereas, the North Carolina General Assembly has provided for state wide minimum standards for swimming pool construction and operation by enacting North Carolina General Statutes 130A-280 et seq., and

Whereas, the North Carolina Commission for Health Services has adopted Rules Governing Public Swimming Pools that became effective in Durham County on May 1, 1992, and

Whereas, the Durham County Board of Health has reviewed the "Rules Governing Public Swimming Pools" (15A NCAC 18A .2500) adopted by the North Carolina Commission for Health Services, pursuant to the authority granted under North Carolina General Statutes 130A-282, and has determined that the said rules will not adequately protect the public health of the citizens of Durham County, and

Whereas, the Durham County Board of Health is of the opinion and finds it necessary that the Board of Health supplement the State's minimum standards for the design, construction, alteration, maintenance, operation, and use of swimming pools in Durham County beyond the scope of the aforementioned State rules, in order to continue to adequately protect the public health of the citizens of Durham County,

NOW, THEREFORE, BE IT RESOLVED, by the Durham County Board of Health that the following regulations are hereby adopted pursuant to the authority contained in North Carolina General Statutes 130A-39 and shall apply throughout Durham County.

GENERAL STATEMENT

It is the intent of these regulations to supplement and enhance the State rules thereby promoting and protecting public health and safety of persons using swimming pools for swimming, diving, recreational bathing, or special pools for therapeutic purposes in Durham County.

Section I. SCOPE AND PURPOSE

These regulations supplement the State Rules Governing Public Swimming Pools, 15A NCAC 18A .2500, and shall apply to all swimming pools within Durham County; however, private swimming pools as defined by these regulations, shall be exempt from all requirements.

Section II. DEFINITIONS

The definitions of Section 15A NCAC 18A .2508 are hereby incorporated by reference. Additionally, the following definitions shall apply in these regulations:

- A. **Owner** The owner of the swimming pool, or responsible management company.
- B. **Operator** The certified pool operator who is responsible for the daily operation of a public swimming pool.
- C. **Swimming-Pool** Any structure, basin, chamber, or tank containing an artificial body of water which may be used for swimming, diving, wading, instructional purposes, or therapeutic bathing. The term as used herein shall include public swimming pools as defined in 15A NCAC 18A .2508(2). The term shall include recreational attractions including, but not limited to, water slides and wave pools and their auxiliary structures including buildings, appurtenances, and equipment used collectively by the public and operated by any person as owner, lessee, operator, or concessionaire, regardless of whether a fee is charged for use.
- D. **Private Swimming Pool** Any swimming pool located on private property under control of the homeowner, the use of which is limited to swimming or bathing by members of the family and invited guests.
- E. **Pool Area** The interior of the fenced area around a swimming pool including the swimming pool, interior of the bathhouse, equipment room, and chemical storage area associated with the swimming pool.
- F. **Operation Permit** The Durham County permit required for the operation of a swimming pool in Durham County.
- G. **Health Director** The Durham County Health Director or his/her authorized representative.

The requirements of Section III are now covered under 15A NCAC 18A .2509

**Section III. APPROVAL OF PLANS AND POOL CONSTRUCTION**

- A. Construction, beginning after the effective date of these regulations shall comply fully with the regulations herein.
- B. No person shall construct, install, extend, or modify a public swimming pool unless the plans and specifications for such work have been submitted to and approved in writing by the Health Director.
- C. Application for approval of such plans and specifications shall be made on forms provided by the Health Director.
- D. Plans shall be drawn to not less than one eighth inch to the foot scale. Plans shall include the following:
  - 1) Site plan, including pool, deck and any other appurtenant buildings,
  - 2) Plan and sectional view dimensions of both the pool and the area enclosed by the barrier fence,
  - 3) Plans and layouts for the bathhouse, equipment room, and chemical storage room,
  - 4) Specifications, of all treatment equipment used and their layout in the equipment room,
  - 5) One piping schematic showing piping, pipe size, inlets, main drains, skimmers, gutter outlets, vacuum fittings, fill line and all other appurtenances connected to the pool piping system,
  - 6) Specifications for the water supply and wastewater disposal systems. This would include aspects such as well location, sewage disposal system location, and backwash water disposal where applicable,
  - 7) A fencing detail,
  - 8) A lighting schedule,
  - 9) A safety equipment detail showing location and specifications of safety equipment provided.

- E. The Health Director shall approve the plans and specifications only if they comply with the standards of construction, design, and equipment as required by these regulations and the State Rules Governing Public Swimming Pools 15A NCAC 18A .2500, hereby incorporated by reference. The Health Director shall retain a full set of plans as approved.
- F. The swimming pool shall be constructed in accordance with the plans approved by the Health Director and shall be subject to all conditions and/or revisions noted as part of the written approval. Inspections at the construction site may be made as is necessary to assure that construction is according to approved plans.
- G. The swimming pool contractor shall notify the Health Director when construction is completed and request a final construction inspection. The swimming pool contractor shall furnish the Health Director a statement from the design engineer that construction is in accordance with the approved plans, periodic inspections will be necessary by the engineer or his/her representative. The swimming pool contractor shall furnish the owner with a complete set of plans which show, as built, the location of all pipes, and the connections of all equipment.
- H. All swimming pool slides proposed for use at a public swimming pool will be evaluated individually.
- I. Equipment replacement shall be approved by the Health Director and comply with these rules and the State Rules Governing Public Swimming Pools, 15A NCAC 18A .2500.

#### Section IV. OPERATION PERMITS

The requirements of section IV are covered under 15A NCAC 18A .2510 except where noted.

- A. An operation permit shall be required for the operation of a public swimming pool in Durham County.
- B. An operation permit shall be issued when an inspection of the swimming pool by the Health Director indicates the facilities are in compliance with these regulations. Operation permits shall be valid for a period of not more than twelve months and shall be subject to provisions as noted on the permit form governing any operational limitations necessary to assure full compliance with these regulations. All operations permits will expire at the end of the calendar year.  
State rule allows year-round permits to be valid for 12 months from the date of issuance.
- C. A separate Application for Operation Permit form must be submitted to the Health Director for each pool. The owner or operator shall apply annually for an operation permit.

The requirements of Section V are covered under 15A NCAC 18A .2511 except where noted.

## Section V. INSPECTIONS AND REPORTS

- A. The Health Director shall make such inspections, surveys, and investigations, collect samples of water and other substances found on the premises of public swimming pools, and make or cause to be made such laboratory analysis as may be necessary to determine that every swimming pool complies with the standards and requirements set forth in these regulations. The Health Director is authorized and empowered to enter upon and make inspections of the premises at any reasonable time. The operator shall assist in any reasonable way with such inspections.
- B. It shall be the duty of every permit holder to maintain and furnish to the Health Director such records and information as may be required by the Health Director for ascertaining compliance with these regulations.
- C. It shall be the responsibility of the owner/operator to report to the Health Director, within seventy-two (72) hours, any accident or illness, related to the swimming pool, that requires treatment in an acute care setting.

Sec V(C) requires reporting within 72 hours. 15A NCAC 18A .2540 requires reporting within 2 working days.

## Section VI. RESPONSIBILITIES OF OWNERS AND OPERATORS

The requirements of Section VI are covered under 15A NCAC 18A .2535

- A. It shall be the responsibility of the owner to insure that the pool has an operator with current certification, and that the operator is properly trained and capable of operating the swimming pool in compliance with these regulations.
- B. It shall be the responsibility of the pool operator to insure a valid Operation Permit has been obtained from the Health Director prior to the pool opening.
- C. Operators of swimming pools shall undergo and satisfactorily complete a Certified Swimming Pool Operator course licensed by the National Swimming Pool Institute or an equivalent course as determined by the Health Director.
- D. It shall be the responsibility of the operator to maintain and furnish to the Health Director such records as may be required for ascertaining compliance with these regulations. Records shall include, but not be limited to:

1) Daily recordings of measurements of disinfectant residuals taken at least three (3) times during each day of operation. The time and date of each measurement shall be recorded,

2) Daily recordings of measurements of pH levels which shall be made at the same time disinfectant residuals are measured as noted in (1),

Section VI(D) - 15A NCAC 18A .2535(11) requires the operator to record this information once daily. We have no justification for the more stringent local requirement.

- 3) Recordings of measurements of the cyanuric acid shall be made weekly, if applicable,
  - 4) Recordings of all activities pertaining to the operation of the pool, including superchlorination and the addition of all chemicals necessary for proper maintenance of the water quality standards,
  - 5) Daily recordings of copper and silver residuals, if applicable,
  - 6) Weekly recordings of total alkalinity,
  - 7) Daily recordings of temperatures of heated pools and spas.
  - 8) A checklist of maintenance guidelines to be provided by the Department
- E. A certified pool operator (CPO) shall physically inspect each pool at least daily. If the CPO is temporarily unable to inspect the pool, provisions shall be made for an alternate CPO to make the required inspection.
- F. All operators of Public Swimming Pools in Durham County shall register annually by April 15 with the Department and must list all pools under the operator's responsibility.
- G. The owner of the pool shall notify the Durham County Health Department within seven (7) days of the termination of the employment of an operator of the pool. If a qualified operator cannot be employed within seven (7) days of the previous operators termination, the pool shall be closed.

## Section VII. WATER QUALITY TEST EQUIPMENT

The requirements of Section VII are covered under 15A NCAC 18A .2535(10) except where noted.

- A. A disinfectant residual testing device shall be provided at each public swimming pool as follows:
- 1) Where Free Chlorine is used as a disinfectant, an indicator capable of measuring residual free chlorine in the pools shall be used, and be graded between zero point one (0.1) parts per million (ppm) and three point zero (3.0) parts per million (ppm) and shall have at least four intermediate increments.

2) Where Bromine is used as a disinfectant, an indicator capable of measuring residual bromine in the pools shall be used, and be graded between one point zero (1.0) parts per million (ppm) and five point zero (5.0) parts per million (ppm) and shall have at least four (4) intermediate increments.

3) A high level chlorine test kit shall be required at all pools measuring to ten (10) ppm and shall have at least four (4) intermediate increments.

Section VII(3) - Not required by State rule, no justification exists for this local requirement.

- B. A testing device for measuring the pH of pool water shall be provided at each swimming pool. It shall be graded from six point eight (6.8) to eight point four (8.4) and shall have at least four (4) intermediate increments
- C. A testing device for measuring Copper/Silver Ion residuals shall be provided at each pool, if applicable.
- D. A testing device for measuring Cyanuric Acid shall be provided at each pool, if applicable.
- E. A testing device for measuring Total Alkalinity shall be provided at each pool.
- F. All pools equipped to be heated shall have a metal stem or shatter protected thermometer capable of measuring water temperature to at least 110 degrees F with a range of accuracy of not greater than plus or minus 2 degrees F.

The requirements of Section VIII are covered under 15A NCAC 18A .2535 except where noted.

#### Section VIII. WATER QUALITY STANDARDS

- A. Water shall not show positive tests for fecal coliform organisms at any time while pool is in operation.
- B. The chemical quality of the water shall be maintained in an alkaline condition at all times the pool is in operation with the pH between 7.2 and 7.8.
- C. When chlorine is used as a disinfectant, a Free Chlorine Residual of at least one point zero (1.0) parts per million (ppm) shall be maintained at all times the pool is in operation.
- D. When bromine or compounds of bromine are used as the disinfectant, a Bromine Residual of at least two point zero (2.0) parts per million (ppm) shall be maintained at all times the pool is in operation.
- E. When silver/copper ion systems are used, the copper concentration in the water shall not exceed one point zero (1.0) parts per million (ppm).

Section VIII(E) - Covered under 15A NCAC 18A .2535(8). Furthermore, no pools in Durham County use this type of disinfection.

Section VIII(J) - The presence of small accumulations of algae on surfaces is not considered a critical violation. An intent to suspend the permit may be issued if the algae cannot be cleaned during an inspection. Large quantities of algae are usually indicative of no disinfectant in the water which results in immediate permit suspension. Fecal and disinfectant closures are covered under 15A NCAC 18A .2535

- F. When cyanuric acid is required to be used, the cyanuric acid concentration shall not exceed one hundred (100) parts per million (ppm).
- G. The water in a swimming pool shall be maintained at such clarity so that the main drain cover located in the deepest part of the pool is clearly visible from the pool deck.
- H. Floating scum and debris shall not be allowed to accumulate in the pool.
- I. Automatic chemical feeders that are NSF listed shall be used when chlorine, bromine or compounds of bromine are used as a disinfectant. Feeders shall be installed in accordance with NSF Standard 50 which is incorporated by reference.
- J. A pool shall be closed by the operator for the following violations of the water quality standards:
  - 1) Presence of algae
  - 2) Presence of fecal material
  - 3) No measurable presence of disinfectant

The pool shall be superchlorinated properly, in accordance with recommended guidelines from the National Swimming Pool Foundation, and shall remain closed for a period of not less than 24 hours.

- K. Violation of ANY of the above water quality standards as prescribed in these regulations shall be grounds for immediate suspension of the operation permit.

Section VIII(K) - Clear guidance is given in 15A NCAC 18A .2535 regarding critical water quality violations that result in immediate permit suspension.

#### Section IX. FENCES

Fencing requirements are addressed in 15A NCAC 18A .2528. \*\*See note for section IX(A)(3).\*\*

- A. Swimming pools shall be protected by a fence, wall, building, or other enclosure, or any combination thereof, which completely encloses the swimming pool area. The fence shall be designed to meet the following criteria:
  - 1) The fence or barrier shall be at least forty eight (48) inches in height from the outside approach. Properties having a fence completely surrounding the swimming pool of at least forty-two (42) inches in height shall have until April 1, 1995 to bring the fence into compliance with this provision.
  - 2) Entrances through the fence or barrier shall be provided with self closing, self latching gates,

Section IX(A)(3) conflicts with a more stringent standard required in rule 15A NCAC 18A .2528(a)(2). The state rule requires that a sphere of no more than 4 inches in diameter may pass.

3) Openings under and through a fence or barrier with the gate closed shall be sized so that a four and one half inch sphere cannot be passed through the openings. Properties having a fence completely surrounding the swimming pool with spacing of vertical components not greater than six (6) inches shall have until April 1, 1995 to bring the fence into compliance with this provision.

4) Shrubbery or plants are not acceptable as a fence or barrier for purposes of this regulation.

5) Gates provided specifically for access to equipment rooms shall be locked at all times when not in use by the pool operator.

#### Section X.

#### EQUIPMENT AREA

The requirements of Section X are covered under 15A NCAC 18A .2533

- A. Chlorinators, brominators, filters, pumps and other electrical equipment shall be sheltered and protected in a weatherproof enclosure.
- B. A permanent means of access, such as a stairway or ramp, shall be provided to all equipment areas. The entrance to the equipment enclosure shall be kept locked at all times.
- C. Adequate clearance between walls, ceiling, floor and equipment shall be provided to allow for inspection, maintenance and repair operations.
- D. Floor drainage shall be provided in the equipment enclosure and interior surfaces of the enclosure shall be kept free of any accumulation of water.
- E. The interior of the enclosure shall be provided with a minimum of ten (10) foot candles of light on all gauges and valves.
- F. Natural or forced air ventilation shall be required. Cross-draft ventilation is recommended.
- G. All public swimming pools shall provide backflow protection for the water supply and wastewater disposal systems in accordance with 15A NCAC 18A .2512 - .2513, hereby adopted by reference.

#### Section XI.

#### CHEMICAL STORAGE AREA

The requirements of Section XI are covered under 15A NCAC 18A .2534

- A. Chemical storage shall be provided at all swimming pools in a dry, weatherproof enclosure, which shall be separate from the enclosure provided for pumps, filters or other electrical equipment.

- B. Floor drainage shall be provided in the chemical storage enclosure and interior surfaces of the enclosure shall be kept free of any accumulation of water.
- C. Chemical storage enclosures shall be constructed so as to be fire resistant. Chemicals shall be stored on nonflammable shelving or platforms and at least twelve (12) inches above the floor.
- D. The entrance to the chemical storage enclosure shall be kept locked at all times.
- E. The interior of the enclosure shall be provided with a minimum of ten (10) foot candles of light.
- F. Emergency eye wash stations shall be provided in the chemical storage area.
- G. Natural or forced air ventilation is required. Cross-draft ventilation is recommended.

**Section XII. MAINTENANCE OF THE POOL AND POOL AREA**

The requirements of Section XIII are covered under 15A NCAC 18A .2537 except where noted.

- A. All parts of the pool shall be maintained in good repair and kept clean, sanitary and free from litter, broken glass or other hazardous materials. The pool floor and walls shall be kept free from cracks and other defects, painted or otherwise treated to maintain cleanable surfaces.
- B. Pool equipment shall be maintained in good repair. If at any time the filter equipment, chemical feed system, or pump becomes inoperative, or if the main drain cover has been removed or broken, the operator of a swimming pool shall immediately close the pool. Failure to close the pool shall be grounds for immediate suspension of the operation permit.
- C. Drain covers, face plates, fittings and skimmers shall be in place, secured and maintained in good repair.
- D. Ladders, stair rails, diving equipment and pool slides shall be maintained in good repair and securely fastened in place. Contrasting color bands at least 2 inches wide shall be applied and maintained on the leading edge of each stair tread.
- E. Pool decks shall be kept in good repair, free from cracks or offsets of more than one-half inch. Decks shall be kept clean, sanitary and free from litter.

Section XII(E) is covered under 15A NCAC 18A .2522

- F. Floors, walls and ceilings of bathhouses, equipment enclosures and chemical storage enclosures shall be maintained in a manner so as to be slip resistant and in good repair. Toilets, urinals, showers, lavatories, and other plumbing fixtures shall be kept clean and in good repair.
- G. Fences and gates shall be kept in good repair.
- H. All loose or broken coping shall be repaired.
- I. Artificial lighting shall be provided in accordance with 15A NCAC 18A .2524, hereby adopted by reference, for all pools used when natural lighting is not sufficient to make all parts of the pool and pool area clearly visible.
- J. Underwater light niches shall be maintained or covered so as to not present a potential hazard to bathers.

**Section XIII. POOL SAFETY \*\*\*See comment for Section XIII(i)\*\*\***

The requirements of Section XIII are covered under 15A NCAC 18A .2530 except where noted.

- A. All swimming pools shall have at least one unit of life saving equipment conspicuously displayed and readily accessible. A unit of life saving equipment shall consist of the following:
  - 1) A light, strong pole not less than twelve (12) feet long, including a body hook,
  - 2) A U.S. Coast Guard approved ring buoy with a minimum one-fourth inch diameter throw rope at least fifty (50) feet long.
- B. Two units of lifesaving equipment must be provided for any pool which exceeds 3,000 square feet (186 square meters) of total surface area.
- C. A telephone shall be made available to the pool area and emergency numbers shall be posted at the telephone.
- D. When a lifeguard is not provided, a sign shall be posted stating, in four (4) inch letters, "WARNING- NO LIFEGUARD ON DUTY." Notice that children should not swim without adult supervision and that adults should not swim alone shall also be provided and permanently mounted.

\*\*\*Drain cover regulations have been superseded by more stringent state and Federal requirements. 15A NCAC 18A .2518, .2539, and 15 U.S.C. 8001 (et seq.) now regulate pool drains.\*\*\*

- E. Any wading pool which is not continuously under the supervision of a lifeguard shall post a sign stating, in four (4) inch letters, "WARNING- NO LIFEGUARD ON DUTY".
- F. Depth markers, at least four (4) inches in height, shall be provided on the pool walls and on the deck, on the sides and ends of the pool.
- G. A minimum 3/4 inch diameter safety rope shall be provided at the breakpoint where the slope of the bottom exceeds 1 to 10 vertical rise to horizontal distance. The position of the rope shall be marked with colored floats at not greater than a five-foot spacing and a 2 inch wide contrasting color band across the pool bottom.
- H. All outdoor swimming pools or spas must be equipped with at least one (1) outside rinse shower if indoor showers are not provided.
- I. All spas and wading pools shall be equipped with anti-vortex drain covers, which cannot be removed without tools. The operator shall inspect the drain cover daily.
- J. All heaters shall be equipped with thermostatic controls capable of assuring that the maximum temperature of spa water does not exceed 104 degrees Fahrenheit (40 degrees C), and the maximum operating temperature of pool water does not exceed 90 degrees Fahrenheit (32 degrees C).
- K. All pools where diving is prohibited or where the depth of the water is less than five (5) feet shall provide notice on the deck that diving is prohibited, in letters at least four (4) inches in height and in contrasting color to the deck. Such notices shall be at intervals of not more than twenty-five (25) feet and within eighteen (18) inches of the pool edge. The international symbol (red circle with a slash through a diver) for no diving on a minimum four (4) inch by four (4) inch tile or painted at least four (4) inches in height on the pool deck at intervals of not more than fifteen (15) feet and within eighteen (18) inches of the pool edge may be used.

Members of competitive swim teams may dive into water less than five (5) feet deep provided they are notified of the depth of water, adequately supervised, properly trained in techniques of race diving, and participating in an organized practice or swim competition.

- L. Any swimming or wading pool which has a single drain or skimmer for the circulation of water shall be required to post a sign in three (3) inch letters stating "CAUTION: THE REMOVAL OF THE DRAIN COVER BY UNAUTHORIZED PERSONNEL COULD RESULT IN SERIOUS HARM OR INJURY." \*\*\*See comment for Section XIII(i)\*\*\*
- M. A sign shall be provided in the pool area which states the pool rules including a provision prohibiting pets and glass containers in the pool area.
- N. Notice shall be provided in the pool area that in case of accident or injury the pool operator must be notified within twenty-four (24) hours. The name and telephone number of the pool operator shall be provided.

#### Section XIV. FACILITY CLOSURE

Hydrostatic relief valves are required under 15A NCAC 18A .2515(b)

If the public swimming pool is closed for two (2) weeks or longer, the facility should be appropriately cleaned, covered, or secured with a fence to prevent access of foreign material, animals or humans. If drained, care should be taken to ensure that the facility is not damaged by subsurface hydrostatic pressure and that access by animals and humans is restricted. If a public swimming pool is to be closed permanently, the facility/pool shall be filled in or removed and the water and drainage connections removed. Written notification must be made to the Department. Any public swimming facility/pool left in a state of disrepair or out of service for more than one (1) swimming season shall be drained and secured so as to not create a nuisance.

Access is restricted by the fencing requirements of 15A NCAC 18A .2528

#### Section XV. SUSPENSION AND REVOCATION OF PERMITS

Permit suspension and revocation authority is granted under § 130A-23(d) and described in 15A NCAC 18A .2511

- A. The Health Director may summarily suspend or revoke an operation permit issued in accordance with these regulations upon finding that a violation of the applicable provisions of these regulations or a condition imposed on the permit has occurred. A permit may also be suspended or revoked upon a finding that its issuance was based upon incorrect or inadequate information that materially affected the decision to issue the permit.
- B. Any pool where its operation permit has been suspended, revoked or expired shall provide notice, at the entrance(s) to the pool, that the pool is closed. The operator shall physically sequester the pool area to prohibit access until the operation permit has been restored.

- C. If the operation permit of a pool has been suspended, the pool operator shall notify the Health Director when the pool is ready for a reinspection, to reinstate the operation permit. A reinspection must be made by the Department within 10 working days.
- D. If the operation permit of a pool has been revoked, the pool owner or operator must go through the entire application process before a new permit can be issued.

#### Section XVI. APPEAL PROCEDURE

Appeals from suspension, revocation or denial of any permit issued under these regulations and concerning the interpretation and enforcement of these regulations shall be conducted in accordance with North Carolina General Statutes 130A-24 (b) through (d).

#### Section XVII. PENALTIES

If any person shall willfully violate any of these regulations or shall willfully fail to perform any acts required by these regulations, he/she shall be guilty of a misdemeanor and shall be subject to punishment as provided in North Carolina General Statutes 130A-25 and revocation of any permit issued pursuant to these regulations.

#### Section XVIII. INJUNCTIONS

If any person violates any of these regulations or if any person hinders or interferes with the proper performance of duty by the Health Director, the Health Director may institute an action in the Superior Court of Durham County for injunctive relief as provided in North Carolina General Statutes 130A-18.

#### Section XIX. SEVERABILITY

If any provision of these regulations or the application thereof to any person or circumstances is held invalid, the remainder of the regulations and the application of such provisions to other persons or circumstances shall not be affected thereby.

Section XX.

EFFECTIVE DATE

These regulations adopted by the Durham County Board of Health shall be effective from and after January 1, 1994. [ Amended February 24, 1994. Enforcement effective June 1, 1994] These rules amended effective March 17, 1994.



Chairman  
Durham County Board of Health



Director  
Durham County Health Department





## Public Health

June 19, 2014

Durham County Board of Health

Subject: Repeal of Local Swimming Pool Rules

Dear Durham County Board of Health:

It is my recommendation that the “Regulations Governing Public Swimming Pools in Durham County” be repealed. The original intent of the rules was to protect public health by correcting perceived deficiencies of the “Rules Governing Public Swimming Pools” 15A NCAC 18A .2500 (et seq.) adopted by the North Carolina Commission for Public Health Services (eff. April 4, 1990). During the 20 years since the local rules became effective, subsequent revisions to the State rules and the enactment of the Virginia Graeme-Baker Pool and Spa Safety Act, 15 U.S.C. 8001 (et seq.) have rendered the local pool rules obsolete. Furthermore, the local rules are in direct conflict with some of the more stringent standards required by State and Federal law (see comments found on the supporting documentation).

In light of the foregoing it is in the best interest of this Department and the citizens of Durham North Carolina to repeal the local rules and rely solely upon 15A NCAC 18A .2500 *et seq.* and the Virginia Graeme-Baker Pool and Spa Safety Act, 15 U.S.C. 8001 *et seq.*

Sincerely,  
Gayle Harris, MPH, RN  
Durham County Public Health Director



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## **The Impact of School Daily Schedule on Adolescent Sleep**

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DEDICATED TO THE HEALTH OF ALL CHILDREN™



# The Impact of School Daily Schedule on Adolescent Sleep

Martha Hansen, MS\*; Imke Janssen, PhD‡; Adam Schiff, BS\*; Phyllis C. Zee, MD‡¶; and Margarita L. Dubocovich, PhD§¶¶

**ABSTRACT.** *Objectives.* This study was initiated to examine the impact of starting school on adolescent sleep, to compare weekday and weekend sleep times, and to attempt to normalize the timing of the circadian sleep/wake cycle by administering bright light in the morning. This was a collaborative project involving high school students and their parents, as well as high school and university faculty members, for the purpose of contributing information to the scientific community while educating students about research processes and their own sleep/wake cycles and patterns.

*Methods.* Sixty incoming high school seniors kept sleep/wake diaries beginning in August and continuing through 2 weeks after the start of school in September. Sleep diaries were also kept for 1 month in November and 1 month in February. Early-morning light treatments were given to 19 students in the last 2 weeks of November and the last 2 weeks of February. Neuropsychologic performance was measured with computer-administered tests. Paper-and-pencil tests were used for assessment of mood and vigor. A testing period consisted of 2 consecutive days at the beginning and end of November and at the beginning and end of February. Tests were given 3 times per day, ie, in the morning before school (6:30–8:00 AM), during midday lunch periods (11:30 AM to 1:00 PM), and in the afternoon (3:00–4:30 PM), on each of the test days.

*Results.* Adolescents lost as much as 120 minutes of sleep per night during the week after the start of school, and weekend sleep time was also significantly longer (~30 minutes) than that seen before the start of school (August). No significant differences were found between weekday sleep in the summer and weekend sleep during the school year. Early-morning light treatments did not modify total minutes of sleep per night, mood, or computer-administered vigilance test results. All students performed better in the afternoon than in the morning. Students in early morning classes reported being wearier, being less alert, and having to expend greater effort.

*Conclusions.* The results of this study demonstrated that current high school start times contribute to sleep deprivation among adolescents. Consistent with a delay in circadian sleep phase, students performed better later

in the day than in the early morning. However, exposure to bright light in the morning did not change the sleep/wake cycle or improve daytime performance during weekdays. Both short-term and long-term strategies that address the epidemic of sleep deprivation among adolescents will be necessary to improve health and maximize school performance. *Pediatrics* 2005;115:1555–1561; adolescents, sleep, school, schedule, performance.

Adolescent sleep has received growing attention in the past 10 years. Parents state that sleep problems are common among their children.<sup>1,2</sup> In a community survey, pediatric doctors reported that sleep problems affect the health and well-being of children and families but they themselves were not confident of their ability to manage those problems. Only 38.3% of pediatricians asked adolescents about sleep habits, and <46% of them felt confident of their ability to screen children for sleep problems.<sup>3</sup>

Circadian rhythms or biological sleep patterns among adolescents are thought to be different from those of preadolescents or adults.<sup>4</sup> Adolescents prefer to go to sleep later at night and wake up later in the day, a pattern not typically seen among preadolescents and older adults.<sup>4,5</sup> The delayed phase of sleep and wake cycles in adolescence is probably a result of several factors, including changes in the intrinsic period of the circadian clock and behavioral and social factors that may promote and perpetuate the delayed bedtime and wakening.<sup>6</sup>

The combination of delayed circadian sleep phase and early start times at high schools in the United States causes adolescents to lose sleep during the school week.<sup>4,7,8</sup> Chronic partial sleep loss has negative effects on neurocognitive performance, mood, and health. A large survey of 12- to 15-year-old subjects showed correlations between sleep problems, rebelliousness, depressive symptoms, and cigarette smoking.<sup>9</sup> Sleep deprivation among adolescents causes an increase in inattentive behavior,<sup>3</sup> and daytime sleepiness may affect mood, behavior, and academic performance and even put adolescents at risk for accidents or injury. However, information on these effects and their relationship to adolescent sleep remains inconclusive.<sup>4,6,10–12</sup> Many authors have suggested that more studies are needed to determine the underlying causes of adolescent sleep patterns and their specific relationship to problems and overall functioning in this age group.<sup>1,2,9,11</sup>

Adolescent sleep scheduling is unstable,<sup>13</sup> and there is a marked difference between weekday and weekend sleep during the school year.<sup>4</sup> Sleep times

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and wake times occur later and total sleep time is greater on weekends, which suggests that adolescents are attempting to recover sleep during the weekend.<sup>11,14</sup>

Light is a major synchronizing agent for the circadian clock.<sup>15</sup> Exposure to bright light in the early morning advances circadian rhythms, resulting in earlier bedtimes and wake times.<sup>11,16–18</sup> In addition, the possibility that bright light can increase alertness and enhance performance has been studied.<sup>19–22</sup> Therefore, it seemed possible that exposure to bright light in the morning in the classroom might help normalize the phase of circadian rhythms and sleep, as well as improving students' performance.

The goal of this study was to characterize the impact of sleep loss after the start of school on neurocognitive performance and mood, to examine the relationship of weekday to weekend sleep among adolescents, to determine whether early-morning light treatments given to a portion of the students could improve sleep, mood, and performance, and to educate adolescents regarding the importance of sleep for performance and health. The subjects were all advanced-placement biology students spread throughout 3 sections or classes. They were chosen because the 3 classes were held at different times of day and because these highly motivated students could be subjects of the study and later become involved in scientific research by helping to discuss, process, and analyze the data they generated.

## METHODS

### Protocol

Northwestern University professors and Evanston Township High School science department faculty members first met when Northwestern University faculty members gave a science seminar (in January 1997) on circadian rhythms at the high school. Interest in a collaborative project was generated, and permission was granted by both schools.

Students who had registered for advanced-placement biology for the autumn of 1997 were contacted in June, before the end of the 1996–1997 school year. An informational meeting was held for incoming students and their parents, which was attended by both Evanston and Northwestern faculty members. At that time, consent forms, addressing the procedure for the project, benefits and risks, and confidentiality, were distributed and discussed. The institutional review board of Northwestern University and the administrators at the high school approved this study. Consent was obtained from both the students and their legal guardians. Students had the option to drop out of the study at any time without it affecting their grade or any other activity. Sleep-diary packets were distributed to each student to begin in August 1997, and the procedure for filling them out was discussed.

### Sleep Diaries

Distributed sleep-diary packets included record-keeping sheets, on which students recorded the date, bedtime, wake time, number of awakenings per night, and naps. These diaries were kept for the month of August, the first 2 weeks of September, the last week of October, the first 3 weeks of November (this schedule was moved up 1 week to avoid Thanksgiving vacation), and the entire month of February. Diaries were collected and data were entered into computer databases. Students, some of whom were in the study, performed most of the data entry. Numerous systems for editing and crosschecking the accuracy of the data entered were used to ensure that mistakes were not made.

### Light Treatments

Artificial white light (1800 lux at ~66 cm from the source, for 93 minutes) was administered to the early morning class only on

weekdays from 8:10 to 9:43 AM, from November 10 through November 22 and again from February 16 through February 27. This group is referred to as the light group. The other 2 classes (9:48–11:25 AM and 1:08–2:41 PM) received red-light treatments (100 lux at ~66 cm from the source, for 93 minutes). This group is referred to as the placebo group; the students thought they also were receiving a significant amount of light. All students were confined to a rectangular area of 17.95 m<sup>2</sup> (4.89 m wide and 3.67 m long) for the duration of the daily treatment period. Seating was not always constant, and some students shifted during the period, but all remained in the rectangle and no student received <1800 lux (light group) or <100 lux (placebo group). Blinds in the room were kept shut so that outside light was not a variable. Students were facing the front of the room, and 7 light panels were positioned around the front of the rectangle from 29 cm outside the line of the rectangle containing the students to 103.5 cm outside the rectangle, with the average distance from the rectangle being 66 cm. During placebo treatments, only 4 red lights were used (every other panel) and an additional small red lamp was positioned at the front of the room. During red-light treatments, filters were constructed that fit over the light panels. These consisted of layers of Parafilm covered by transparent red cellophane. Light readings were checked to ensure that no more than 100 lux of light was received in any part of the rectangle during placebo treatment. All light panels were obtained from Medic-Light (Lake Hopatcong, NJ).

### Performance and Mood Tests

Vigilance was assessed as part of the Harvard Cognitive Battery. The Harvard Cognitive Battery consists of 4 tests, ie, 3-dimensional rotation, vigilance, Posner, and reasoning. The Posner and vigilance computer-generated tests measure reaction times. Both tests were administered to each student during each test period. In the Posner test, the student hits the space bar as soon as an asterisk appears on the screen. In the vigilance test, the student pushes a specific key on the computer when a 0 appears instead of a number from 1 to 9. The tests were given 3 times per day, ie, in the morning before school (6:30–8:00 AM), during midday lunch periods (11:30 AM to 1:00 PM), and in the afternoon (3:00–4:30 PM), on each of the test days. Here we report only the morning and afternoon results, because no differences among the groups were found. Macintosh computers (Apple, Cupertino, CA) were used, and results were stored with Mac Lab (D. Costin, dcostin@euco.com). Posner data were not used because these bright students quickly learned the test and were able to score 100% after the first trial. Vigilance tests were more difficult for the students and were judged to be a better assessment of performance reaction times. Paper-and-pencil tests<sup>23</sup> were administered to measure symbol copying, visual search tasks, and logical reasoning. Again, students quickly learned these tests and scored 100% on all of them, thus excluding the data as an accurate measure of performance.

The visual analog scale of vigor and mood<sup>24</sup> was used by students to self-evaluate their feelings in different areas (alert, sad, tense, effort, happy, weary, calm, and sleepy), from very little to very much along a 10-cm line. These distances were later measured. Overall mood and vigor were calculated as follows: global affect = [happy + calm + (200 – sad – tense)]/4; global vigor = [alert + (300 – sleepy – effort – weary)]/4.

### Statistical Methods

Total sleep time, bedtime (minutes before or after midnight), vigilance, global affect, and global vigor were analyzed. Results are expressed as mean ± SEM. The method of analysis was repeated-measures analysis of variance. SAS Proc Mixed (SAS Institute, Cary, NC) was used with fixed effects for analysis for all subjects who provided data for at least 2 time periods (August and September, for example). All results were confirmed with complete cases only.

For the analysis assessing changes in sleep from summer to the beginning of school, 2 within-subjects factors were used, namely, summer (yes/no) and weekday/weekend. For the analysis across time, group (placebo or light) was included as a between-subjects factor. For the analyses of vigilance, global affect, and global vigor, 2 repeated factors, namely, month (ie, November before treatment, November after treatment, February before treatment, or February after treatment) and time of day (morning or afternoon), and 1

between-subjects factor (light, yes or no) were used. Posthoc *t* tests were used subsequently when warranted by overall significant results.

## RESULTS

### Study Subjects

Students kept sleep diaries in August, September, November, and February. A total of 60 students enrolled in the study, but the sample size decreased to 37 from August to September (Fig 1). In November and February, the sample size for sleep (Fig 2) was 55

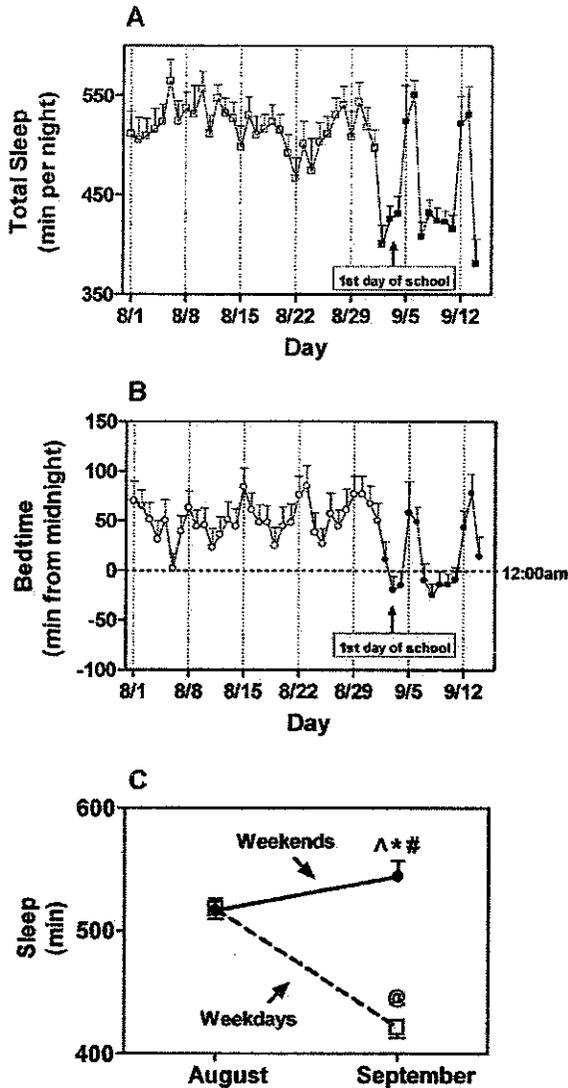


Fig 1. Sleep patterns among high school students before and after the beginning of the school year. A shows changes in sleep per night after school began. The ordinate represents total sleep per night for adolescents from August 1 to September 15, with the first day of school being September 3. The vertical lines denote Fridays ( $N = 37$ ). B shows changes in sleep onset after school began. The ordinate represents bedtime, expressed as the difference in time between the actual bedtime and midnight, for adolescents after school began. The vertical lines denote Fridays ( $N = 37$ ). C shows effects of school start on total sleep during weekends and weekdays. The ordinate represents total minutes of adolescent sleep during weekends ( $N = 36$ ) and weekdays ( $N = 37$ ) from August 1 to September 15.  $\hat{P} = .116$ , compared with weekdays in August.  $*P < .005$ , compared with weekdays in September.  $\#P < .038$ , compared with weekends in August.  $@P < .0001$ , compared with weekdays in August.

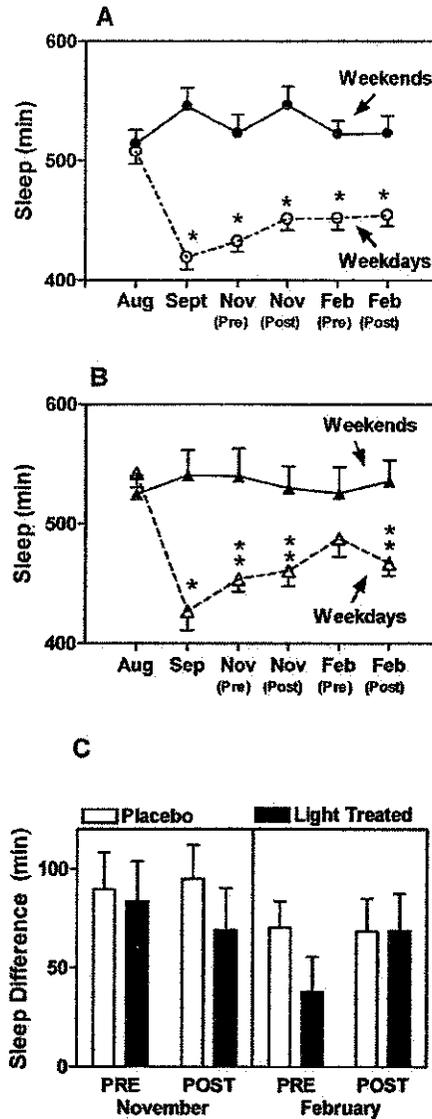


Fig 2. Effects of morning light treatments on total sleep during weekdays and weekends among high school students. A shows the placebo-treated group. The ordinate represents mean sleep per night on weekends and weekdays before (Pre) and after (Post) placebo treatment. Students ( $N = 37$ ) in this group received red-light treatments on weekdays for 2 weeks in November and February.  $*P < .0001$ , compared with weekends. B shows the light-treated group. The ordinate represents mean sleep per night on weekends and weekdays before (Pre) and after (Post) light treatments. Students ( $N = 18$ ) in this group received artificial white-light treatments on weekdays for 2 weeks in November and February.  $*P < .0001$ ,  $**P < .005$ , compared with weekends. C shows differences in sleep time (weekend versus weekday) before and after placebo or light treatments in November and February. The ordinate represents the difference in sleep for weekends versus weekdays before (PRE) and after (POST) placebo or light treatments in November ( $N = 37$  for placebo,  $N = 18$  for light) and February ( $N = 37$  for placebo,  $N = 18$  for light).

(placebo,  $N = 37$ ; light,  $N = 18$ ) and that for vigilance (Fig 3) was 56 (placebo,  $N = 37$ ; light,  $N = 19$ ). The sample size for the visual analog scale (affect and vigor) (Fig 4) in November was 42 (placebo,  $N = 26$ ; light,  $N = 16$ ) and that in February was 48 (placebo,  $N = 30$ ; light,  $N = 18$ ). All students were juniors or seniors enrolled in advanced-placement biology, an elective course.

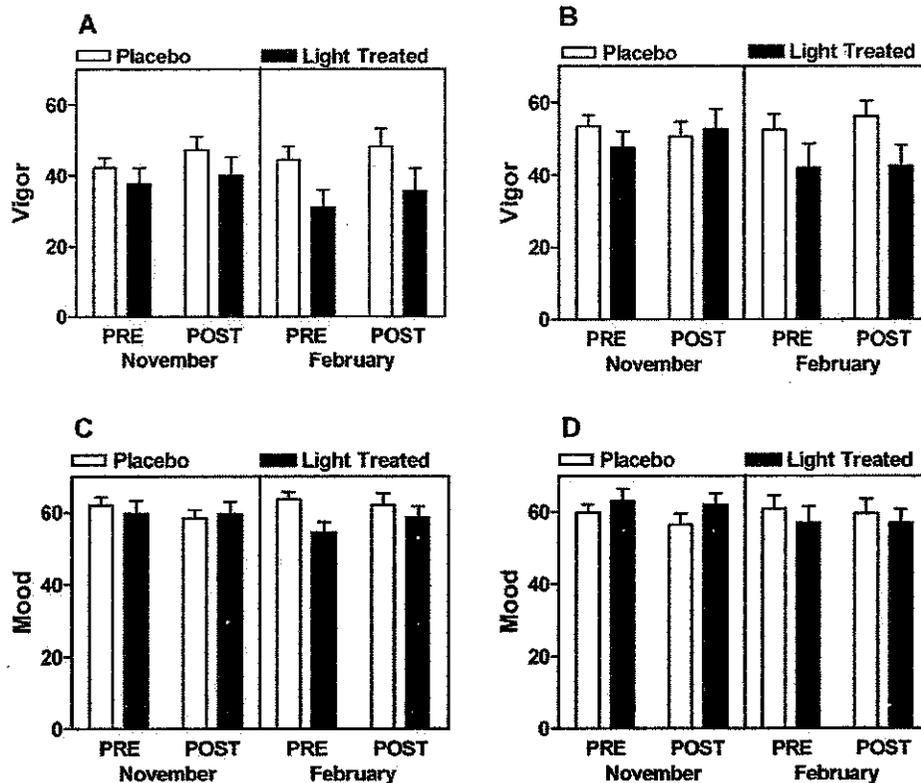


Fig 4. Morning and afternoon global vigor and affect (mood) among high school students before and after light treatments. In A and B, the ordinate represents the students' self-ratings of morning (A) or afternoon (B) vigor before (PRE) and after (POST) light treatments on weekdays for 2 weeks in November ( $N = 26$  for placebo,  $N = 16$  for light) and February ( $N = 30$  for placebo,  $N = 18$  for light). In C and D, the ordinate represents the students' self-ratings of morning (C) or afternoon (D) global affect (mood) before (PRE) and after (POST) light treatments on weekdays for 2 weeks in November ( $N = 30$  for placebo,  $N = 18$  for light) and February ( $N = 26$  for placebo,  $N = 16$  for light).

## DISCUSSION

The results from this study add to the growing body of information being generated to help characterize adolescent sleep patterns and cycles and their effects. The studies by Carskadon and colleagues<sup>4,7,8</sup> reported that students lose sleep after the start of school. In the current study, all students lost up to 2 hours per night but only on weekdays. On weekends, sleep patterns shifted and total minutes of sleep increased, with the difference in the 2 patterns being highly significant ( $P < .0001$ ). Whether the increased amount of adolescent sleep on weekends is an attempt at sleep recovery is not clear.<sup>11,14</sup> This may be true, but the difference between weekend sleep after school started in September and weekday sleep in August was not significant, which suggests that weekend sleep and weekend wake times may represent a return to an intrinsic circadian rhythm that is lost during the week because of the imposed school schedules.

No clear distinction in sleep cycles was seen between students treated with bright light and those treated with dim red light (placebo). There were also no significant differences in global mood, vigor, or performance as a result of early-morning light treatments. It is difficult to know whether light did phase-shift the clock, because both groups needed to get up early. Earlier bedtimes might have been difficult to achieve because of academic (homework) and social

influences. It may be necessary to use different light protocols to adjust bioregulatory systems to reduce competing environmental signals. There was also no significant difference in global mood, vigor, or performance as a result of light treatments, although some of these students thought they were expending greater effort. Students in the placebo group seemed convinced that the lights were affecting them in some way, although they were not clear about exactly what the effect was. Recent work suggested that there might be no direct relationship between light treatments and improved performance on vigilance tests.<sup>25</sup> The possibility also exists that students' subjective perception of the effects light had on them altered their performance and mood in ways that were difficult to assess.<sup>25-27</sup> Our data confirmed earlier work by Kraemer et al.<sup>10</sup> All students in the present study exhibited the same pattern of poor morning performance, compared with afternoon performance ( $P < .001$ ), and all students felt less vigorous in the morning ( $P < .0001$ ) than in the afternoon. The data support these statements, and high school teachers across the country can attest to these data anecdotally, through their experience with students throughout the teaching day.

Data were analyzed to determine whether students' total sleep, mood, and performance improved because of adaptation to the school schedule over time. No clear pattern was seen, although students

### Changes in Sleep After School Began

During the summer, student-recorded sleep diaries started August 1 and continued through September 15, after school began ( $N = 37$ ). The mean sleep per night on weekdays in August was 8.7 hours, and this decreased to 7.0 hours of sleep per night on weekdays in September (Fig 1A). The loss of sleep after school began was highly significant ( $P < .0001$ ) (Fig 1C). There was no significant difference between total sleep per night on weekdays in August and total sleep per night on weekends in August ( $P = .51$ ). After school started, students went to bed earlier during the week in September, making differences in total minutes of sleep between weekday and weekend bedtimes in September highly significant ( $P < .001$ ) (Fig 1B). Average bedtimes on weekends were 1 to 1.5 hours after midnight. There was no significant difference between total minutes of sleep on weekdays in August and weekends in September ( $P = .12$ ) (Fig 1C). However, total sleep on weekends in September was ~30 minutes longer than that on weekends in August ( $P < .0001$ ). Figure 1C shows the total difference in sleep lost on weekdays versus weekends as students went from summer months into the school year.

### Sleep Cycles During School Were Not Phase-Shifted by Early-Morning Light Treatments

The mean sleep per night across the testing period for the placebo group (red-light treatments) and the light-treated group (white light) is shown in Fig 2A and B. Differences in minutes of sleep between weekdays and weekends remained significant for both groups ( $P < .0001$  for placebo and light groups). No significant differences were found in comparing the sleep patterns for the 2 groups ( $P = .25$ ). Students slept more on weekdays in February than in November ( $P < .02$ ), but there were idiosyncratic school schedules in February (late-start days). Students' total amount of sleep increased steadily from September through the end of February ( $P < .001$  for the linear trend), but whether this was attributable to student adaptation to the school schedule, decreasing light because of day length (seasonal effects), school vacation days, or some combination of these various effects is unclear. Changes in total minutes of sleep attributable to light treatments in November and February were not found to be significant for weekdays or weekends ( $P = .90$ ) (Fig 2A).

### Early-Morning Light Treatments During School Showed No Direct Effects on Performance, Global Affect (Mood), or Global Vigor

In the set of graphs dealing with performance (vigilance computer tests), Fig 3A and B are nearly identical, showing that no changes in performance on morning or afternoon vigilance tests were observed for students who received early-morning light treatments. When placebo and light groups were combined and rated on vigilance performance (Fig 3C), all students performed better in the afternoon than in the morning ( $P < .001$ ). Similarly, no significant difference in global vigor (Fig 4A and B)

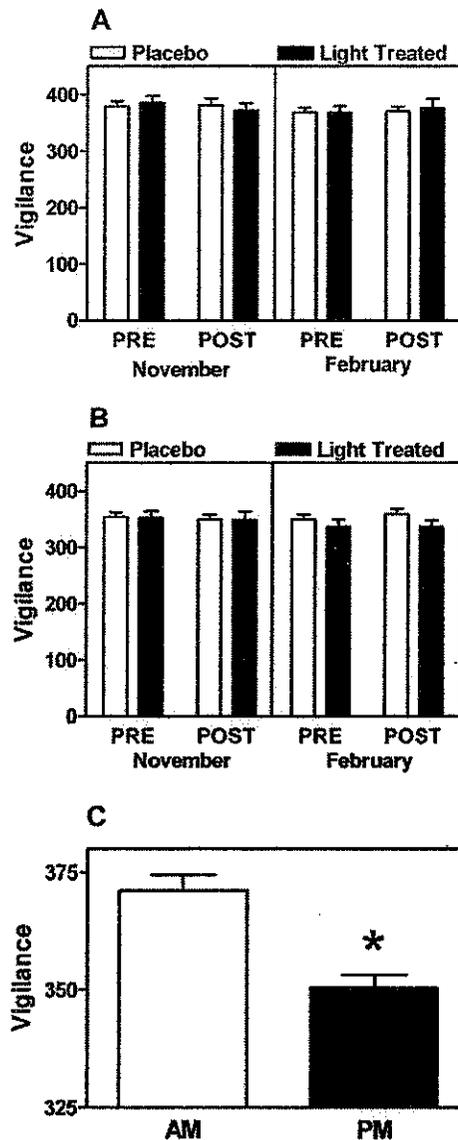


Fig 3. Morning and afternoon performance, determined with computer vigilance tests, among high school students before and after light treatments. A shows the morning test results. The ordinate represents morning performance (vigilance) expressed as reaction time (seconds) before (PRE) and after (POST) light treatments on weekdays for 2 weeks in November and February ( $N = 37$  for placebo,  $N = 19$  for light). B shows the afternoon test results. The ordinate represents afternoon performance (vigilance) expressed as reaction time (seconds) before (PRE) and after (POST) light treatments on weekdays for 2 weeks in November and February ( $N = 37$  for placebo,  $N = 19$  for light). C shows the performance results. The ordinate represents performance (vigilance) expressed as reaction time (seconds) in the morning (AM) or afternoon (PM) for all treatments combined on weekdays for 2 weeks in November and February. \* $P < .001$ , compared with morning.

or global mood (Fig 4C and D) was seen for the light-treated group, compared with the placebo group. Students in the light-treated group reported feeling less vigorous than the placebo group throughout the study ( $P < .0003$ ). All students felt less vigorous in the morning than in the afternoon ( $P < .0001$ ).

slept more on weekdays in November than in February ( $P < .016$ ) and total sleep increased overall from September through February ( $P < .001$ ). Disruptions in the school schedule during these time periods (eg, special late-start days and school holidays) prevented us from forming conclusions about this data; however, the amount of light received by an individual is known to entrain circadian rhythms.<sup>15</sup> Furthermore, the amount of light received daily (governed by seasonal changes in day length), hormonal secretions, and additional sleep time during vacation periods are all variables that need to be considered during the continuing investigation into the factors regulating adolescent biological cycles.

There were several limitations to this study. First, working with volunteer high school students in the high school itself made it difficult to control variables. Second, the sample size decreased to almost one half of the original number because students who missed 1 of 3 scheduled tests on a single test day were eliminated. Third, some students dropped out after the study began. Finally, finding consistent school schedules that could be maintained over time was challenging. Holidays, special late-start days, and all-school testing days made controlling time and test periods problematic.

Another limitation of this study was the homogeneity of the students. Although the high school itself is diverse, all of the students in advanced-placement biology classes fit the profile of being motivated and engaged. This assisted us in obtaining high-quality sleep journal records, but this also brings into question how applicable the data are for all adolescents. Other data addressed very different segments of the adolescent population,<sup>28</sup> and it is hoped that the mosaic of data can be used to construct a clear picture over time.

In retrospect, an important limitation was the failure to obtain performance data in August to use as a baseline. To determine the correlation between sleep deprivation and performance and mood, these data need to be collected when adolescents are in presumably normal sleep cycles, at optimal functioning. Inherent differences in the 3 classes were also not recorded. Figure 2A and B show that, although no significant changes occurred because of light treatments, there might have been significant differences in the starting groups. A background investigation into these variables was not undertaken before the study began.

Finally, although the rewards of a collaborative project between high school and university communities are plentiful, there are also communication difficulties related to time, location, and the very different environments in the respective settings. Projects of this sort are gratifying, but it may be advisable to delineate strengths and weaknesses carefully and to assign specific responsibilities to the various stakeholders at the outset.

### CONCLUSIONS

This study supports the growing evidence that young people have special needs during adolescent

development that are related directly to their intrinsic sleep cycles. School schedules are forcing them to lose sleep and to perform academically when they are at their worst. Solutions to these problems exist but are dependent on continuing research and education.

Light administration might still be the most straightforward intervention to affect adolescent sleep cycles. Therefore, it might be worthwhile to attempt different light protocols. An alternative approach, for example, might involve administration of light treatments in August before school starts and again in September, before sleep patterns attributable to the school schedules become established. In addition, smaller student study groups might be monitored throughout the course of their high school careers. This would enable us to generate data for the same student population over time, as the students grow and develop. It might even be possible to establish a research program to which students would commit for 4 years of high school. With such a program, students could earn credit in science, learn research protocols, and contribute to longer studies on topics such as adolescent sleep.

Another long-term solution involves changing school start times. This process is layered, because it must occur at the state level for coordination of school sports and activities. In addition, state legislators and the public must be convinced of the validity of the findings in this area. A second long-term solution, of necessity, is the continuation of research. As the scientific community unravels the mysteries of human functioning, each piece of information is another part of the puzzle that will begin to reveal the picture of adolescent physiology.

There are many solutions that could be initiated easily now. Education is key. All groups dealing with adolescents (including pediatric doctors, parents, and teachers) and the adolescents themselves need to be more aware of the teenagers' lifestyle patterns, school schedules, and normal sleep cycles and the potential health problems associated with lack of sleep.<sup>3</sup> Education alone may offset sleep loss as young people learn the importance of maintaining regular sleep schedules. Better dissemination of information on adolescent circadian cycles can help doctors, psychologists, and social workers look for associations between certain adolescent behaviors and sleep deprivation effects in this group.<sup>3</sup> Knowledge of the unusual weekday/weekend sleep phenomenon among adolescents could promote better family relationships if parents understood that sleeping late on weekends is part of their children's inborn cycle and not lazy or antisocial behavior.

Another short-term solution that can be implemented is to change the time we give standardized tests to 10:00 AM. Almost all standardized tests in high schools begin at 8 AM. Because this is when adolescents show their poorest performance levels, a change is clearly needed and would be relatively easy to negotiate.

Finally, this project forged a collaboration between high school and university students and faculty members in which everyone learned and benefited

from the experience. The high school students were subjects of research and scientists engaged in research. They were able to learn about the process of collecting and analyzing data and to discover more about the fascinating topic of themselves.

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## The Impact of School Daily Schedule on Adolescent Sleep

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## CLINICAL REVIEW

# Understanding adolescents' sleep patterns and school performance: a critical appraisal

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### KEYWORDS

adolescents, sleep patterns, sleepiness, school performance, self-reported grades, school-reported grades, school start times

**Summary** The present paper reviews and critiques studies assessing the relation between sleep patterns, sleep quality, and school performance of adolescents attending middle school, high school, and/or college. The majority of studies relied on self-report, yet the researchers approached the question with different designs and measures. Specifically, studies looked at (1) sleep/wake patterns and usual grades, (2) school start time and phase preference in relation to sleep habits and quality and academic performance, and (3) sleep patterns and classroom performance (e.g., examination grades). The findings strongly indicate that self-reported shortened total sleep time, erratic sleep/wake schedules, late bed and rise times, and poor sleep quality are negatively associated with academic performance for adolescents from middle school through the college years. Limitations of the current published studies are also discussed in detail in this review. © 2003 Elsevier Science Company. All rights reserved.

## INTRODUCTION

Sleep researchers and clinicians, as well as parents and teachers have had a hunch for years that children and adolescents do not seem to function well in school or at home after a slumber party, a late night out to see a hockey game or movie, or without getting enough sleep for a variety of other reasons. In 1913, researchers Terman and Hocking argued that the key question was, "What is the optimal amount of sleep for physical and mental efficiency?" [1]. Although sleep medicine practitioners have long had a strong sense that irregular sleep schedules or inadequate sleep may lead to poor school performance, the current database

has reached a level that makes it useful to draw research-based conclusions about the impact of sleep on school performance.

The availability of data on factors affecting school performance is important because conclusions are sometimes drawn based on "experience" rather than "experiment". As Meehl articulated in *Clinical Versus Statistical Prediction* [2] and has been demonstrated empirically, clinical observations, judgments, and experiences are inherently unreliable measures of human behavior [3, 4]. Meehl, in particular, argued that the place of clinical observation in the behavioral sciences is only as a source of hypotheses that may be built into a theory, not the substance of conclusion. Until quantitative data establish an acceptable level of scientific support, clinical observations are hunches and not facts. Meehl also argued that one must acknowledge when a methodology is flawed, and therefore, findings may not be meaningful regardless

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of statistical significance [2]. Furthermore, Meehl made it clear that data collection should not stop after completing one study (i.e., "significant" or "not significant"), as only the accumulation of data can be informative [2]. Phenomena such as school performance that are highly complex need aggregation on many levels to reveal reliable processes.

The sleep research field has utilized reliable and valid methodologies for studying sleep—polysomnography, the Multiple Sleep Latency Test (MSLT), actigraphy, and other procedures. The sleep field has been less systematic, however, in attempts to understand sleep's relations to other aspects of human functioning, such as school performance. Although a clear theoretical basis exists for analyzing the associations between sleep habits and academic performance, certain investigators (ourselves included) have made assumptions about how to measure school performance in their attempts to understand the impact of poor sleep habits on school performance. Such assumptions may lead to inadequate appraisal of the phenomenon.

Behavioral scientists use various approaches to assess school performance, however controversy has existed regarding the best method. Academic performance has been assessed through such modalities, grade point average (based on self-report or actual records), self-reported average grades, teacher comments or behavior ratings, school behavior, and parent report. Moreover, a variety of time frames and outcome measures have been utilized: quarterly or semester reports, weekly evaluations, pop quizzes, final exams, standardized tests, tardiness/absenteeism records, graduation, and retention rates. School systems also have varied ratings systems. For example, 68 in one school district may be equivalent to a "D", whereas it may reflect an "F" in another system. On the one hand, the variety of outcome measures may cloud relationships and make it difficult to compare results across studies. Yet, at the same time, use of multiple measures for assessing school performance within a specific study may strengthen the findings.<sup>1</sup>

Much of the behavioral sciences research in this area of school performance has stemmed from a concern

by school administrators, teachers, school nurses, parents, and researchers with the relation between children's and adolescents' health (e.g., nutritional lunches, physical education, etc.) and school performance [5, 6]. For example, investigators have shown that the US Department of Agriculture School Breakfast program reduced tardiness and absenteeism, particularly for those students at greatest risk [7]. Other health researchers have looked at the relationship between school-based health clinics and adolescents' school performance. Specifically, McCord and colleagues examined the effect of health clinic use on at-risk high school students' absences, suspensions, withdrawals, and graduation or promotion rates [8]. They found that students who used the clinic were significantly more likely to remain in school and to graduate or be promoted in comparison to students who were not registered for the clinic.

A number of researchers have also attempted to evaluate the association of sleep habits and academic performance. Since the 1980s, six studies of sleep habits and some aspect of academic performance have been published as abstracts, eight peer-reviewed articles, and one professional report/book (see Table 1). These studies were based almost entirely on self-report for grades and sleep habits; sample sizes ranged from approximately 100–6000 participants; participants' ages (grade in school) ranged from 5th grade through first year in college; and the educational setting varied (i.e., public, independent schools, universities, and variety of countries). The majority of these studies operationally defined academic performance as self-reported Grade Point Average (GPA); however, a few researchers looked at other aspects of school performance, such as concentration/attention, achievement motivation, and attendance/tardiness. While most of the studies focused on self-reported sleep/wake habits, such as bedtime, rise time, and total sleep, others focused more on self-reported sleep quality. All of the studies to date relied on self-reported sleep/wake habits rather than actigraphically estimated sleep and/or polysomnography. It is noteworthy that our lab recently demonstrated the validity of self-report survey estimates of sleep patterns in adolescents through a comparison of retrospective survey descriptions of usual sleep habits with diary-reported and actigraphically estimated sleep behaviors [9].

Moreover, the hypotheses and theories driving the studies have varied. For example, the first studies discussed below assumed that the key relationship is between sleep patterns and school performance,

<sup>1</sup>This review focuses primarily on school performance operationalized as academic grades, in-school tests, etc. as opposed to laboratory performance. Other researchers have focused on laboratory models of performance. For example, Fallone and colleagues provide a thorough review of children's sleepiness and performance (e.g., attention, motor skills, problem-solving, cognitive ability, etc.) in laboratory studies [47].

Table 1 continued

| Study  | Publication type            | Sample size | Age                          | Sex          | Location   | Sleep variable(s)   | School performance variable(s)  | Other variables to explain school performance                   | Key findings   |
|--|-----------------------------|-------------|------------------------------|--------------|--|---|---|---|--|
| <b>School start and phase preference</b>                             |                             |             |                              |              |  |   |   |   |  |
| Allen (Sleep Res, 1992)  | Abstract                    | 102         | Grade 12 (age not specified) | Not reported | 2 schools<br>SST: 7:40<br>SST: 8:30<br>Human behavior classes, but diff. years | Self-report: sleep latency, TST, BT, RT   | Self-report grades, but question not published  | # parties, work hours, alcohol consumed                         | Students with aver. grades later BT than A & B+; parties & wk hrs correl. with late BT & lower grades                                    |
| Epstein et al. (Sleep, '98)  | Peer Rev. Journal           | 811         | 10-12 (M = 10.6)             | Not reported | 18 schools<br>Israel   | Self-report 3 SST (7:10, 7:20-7:55, 8:00) BT, RT, TST sleepiness (Epstein et al., '97; Zomer et al., '84)                         | Self-report: attention, concentration in school (likert scales from Epstein et al., '97; Zomer et al., '84) | Morningness/Eveningness (Horne & Ostberg, '76)                  | Inc. complaints re: attn./conc. early start students   |
| Wahlstrom (CAREI, 2001)  | Technical report, volume II | 7168        | 10-12                        | Not known    | 3 districts  | Self-report 3 SST (8:30, 7:25, 7:15) BT, RT, TST, sleepiness, sleep/wake behavior prob. (questionnaire, Wolfson & Carskadon, '98) | Self-report on survey of usual grades   | Depressed mood, work hours, other daytime functioning questions | Students with better grades: earlier school-night BT, later RT, more TST, fewer sleep prob., later SST district                          |
| Cortesi et al. (Sleep Res, 1997); Giannotti et al. (Sleep Res, 1997) | Abstracts                   | 3040        | 13.8-20.2                    | 60% female   | Students in Italy  | Revised, translated Sleep Habits Questionnaire (Wolfson & Carskadon, '98) TST, BT, RT, sleepiness, sleep problems                 | Self-report of usual grades   | M/E scale (not defined)   | E-types: poor school achievement, fell asleep in class, later BT, RT, less TST; Dec. TST & inc sleepiness assoc. poor school achievement |

Table 1. Sleep habits, sleep quality and school performance studies in preadolescents, adolescents, and college-age students

| Study  | Publication type            | Sample size | Age                              | Sex          | Location  | Sleep variable(s)  | School performance variable(s)         | Other variables to explain school performance                    | Key findings  |
|--|-----------------------------|-------------|----------------------------------|--------------|---|--|--|--|---|
| <b>Sleep/wake patterns and grades</b>                        |                             |             |                                  |              |   |  |  |  |   |
| Link & Ancoli-Israel (Sleep Res, '95)                        | Abstract                    | 150         | 15-18 (M = 16.2)                 | 63% female   | Public HS, Southern CA  | Self-report BT, RT, TST, # naps, sleepiness                                | Self-report GPA                        |  | More TST, dec. sleepiness, higher GPA   |
| Kalin et al. (Pediatrics, '89); Blum et al. (Sleep Res, '90) | Peer-Rev. Journal; Abstract | 972         | 6-10                             | 46% female   | 5 Belgium schools   | Parent report Poor sleepers vs Good sleepers                               | Unclear how school achievement defined | Parental education   | Poor sleepers more school problems than good; Fatigue and parent educ. best predictors for school failure |
| Hofman & Steenhof (Sleep/Wake Res, Netherlands, '97)         | Peer-Rev. Journal           | 604         | 12-18                            |              | 6 high schools, Utrecht, Netherlands (3 levels of education, not clearly explained) | Self-report BT, RT, sleep lag, time in bed (TIB), alertness, sleep quality | Self-report (not explained)            | Drug use, level of educ  | School perf. related to sleep quality, inc. TIB, small sleep lag  |
| Wolfson & Carskadon (Child Dev, '98)                         | Peer-Rev. Journal           | 3120        | 13-19                            | 52% female   | 4 Public HS in So. New England, 3 Districts   | Survey TST, BT, RT (school/weekend) Weekend delay, oversleep               | Self-report survey of usual grades     |  | A/B students earlier BT, RT, inc. regularity than C, D, F students  |
| Trockel et al. (Amer College Health, '00)                    | Peer Rev. Journal           | 185         | 1st yr. college, living in dorms | Not reported | University  | Survey/tel. Interview: BT, RT, TST   | Semester GPA from student records      | Exercise, eating, mood, stress, social support, religious habits | Regression: sleep habits (later RT) assoc. low GPA vs other var ( $\beta = -0.37$ ).                      |
| Kelly et al. (College Student Journal, '01)                  | Peer Rev. Journal           | 148         | 18-42 (M = 19.9)                 | 51% female   | University Intro. Psych. class  | $\leq 6$ h (23), 7-8 h (107), $\geq 9$ h (18) compared                     | Self-report overall college GPA        | Sex  | Short sleepers lower GPA than long  |

whereas other studies attempted to look at school start times, sleep, and grades or circadian rhythms factors (e.g., comparing grades of owls vs larks), sleep and academic performance. This literature is reviewed in the sections that follow. Table I provides a summary of the papers under discussion.

## SLEEP AND ACADEMIC PERFORMANCE

### Sleep-wake patterns and grades

We focus here principally on studies in which survey data on sleep habits and academic performance was collected from middle school, high school, or first-year college students. In an abstract report, Link and Ancoli-Israel assessed the sleep and grades of high school students in a survey study of 150 high school students [10]. Students were asked to report their GPAs and sleep/wake schedules. Students with higher GPAs reported later school rise times, earlier rise times on weekends, shorter sleep latencies, fewer night wakings, and fewer school day naps. The study included a comparison of sleep habits for students with GPAs  $\geq 3.5$  and those with GPAs  $< 3.5$ . The students with lower GPAs reported signs of daytime sleepiness (falling asleep or fighting to stay awake while riding bus/car) more frequently; the students with better grades woke up later on school mornings, woke up less often during night, and took fewer naps. Another noteworthy finding was a trend for the students who reported better grades to report sleeping longer on school nights (7.4 vs 7 h).

In another study, Kahn and colleagues reported data on 972 older children and preadolescents in Belgium [11]. In this study, participants' parents completed a questionnaire focused on quantity and quality of sleep, family background, children's daytime behavior, and school achievements. Poor versus good sleepers were compared (e.g., poor sleep was defined as the report of sleep latency longer than 30 min plus more than one arousal per night on at least 2 nights per week). Fourteen percent of the participants were classified as poor sleepers. Although it was not clear how school performance was assessed in this study, it seemed to be based on whether or not the study participant met academic requirements for their grade (e.g., failed or behind in school) as reported by the parent. Among these poor sleepers, 21% failed at school and were behind in grade by one or more years. School achievement difficulties were significantly more

frequent among the poor sleepers than among youngsters without sleep difficulties. In a later abstract report [12] based on the same sample, a regression analysis showed that the best predictors of school failure were the children's fatigue (operationalized as difficulty to arouse in the morning and need for at least one daytime nap) as well as the parents' educational level.

In another study of European adolescents, Hofman and Steenhof surveyed about 600 Dutch high school students [13]. The survey queried sleep habits, sleep quality, and school performance, and the following sleep variables were derived: weekday bedtime, rise time, weekend bedtime, rise time, sleep lag (difference between weekday and weekend bedtimes and rise times), time of peak alertness, sleep quality, and total time in bed. It is unclear how school performance was operationalized in this report. Using a multiple regression analysis, these investigators found an association of better school performance with more time in bed, better sleep quality, and a shorter sleep lag. They pointed out that better school performance was also related to reduced reported drug use (e.g., alcohol, caffeine, nicotine).

The report of Wolfson and Carskadon [14] supported and extended findings from a number of these studies. About 3000 high school students in southern New England completed a Sleep Habits Survey. The survey included items for usual bedtimes, rise times, and total sleep times and a number of other questions about sleep habits. The Survey also asked the students to select a category that represents his/her usual grade (e.g., mostly As, As & Bs, mostly Bs, etc.). The study found that high school students with self-reported higher grades reported significantly more total sleep and earlier bedtimes on school nights than did students with lower grades ( $p < 0.001$ ). These sleep habits differences distinguished students reporting Cs and worse from those reporting mostly Bs or better. Specifically, students reporting mostly Bs or better reported getting, on average school nights, 17–33 min more total sleep and going to bed 10–50 min earlier than C and D/F students. Students' weekend sleep habits also differed according to self-reported grades: A and B students reported earlier bedtimes and earlier rise times than did C and D/F students; however, self-reported grades did not distinguish the students on reported weekend total sleep. Finally, students with worse grades reported greater weekend delays of their sleep schedules than did those with better grades. Thus, C and D/F students reported going to bed on average about 2.3 h later on weekends than on

|   |                            |                |  |             |   |   |   |  |
|---|----------------------------|----------------|--|-------------|---|---|---|--|
| Lack (College Health, 1986)                                     | Peer Rev. Journal          | 211            | 1st yr. College students (16-50, M = 23) | 65% female  | 1st Year Psych. Students, Univ. So. Australia | Self-report: BT, RT, sleep quality, sleep difficulties; criteria for DSPS                         | Self-report final first-yr psych. course grade  | DSPS group lower grades vs other sleep disturbance group & rest of sample  |
| Wahlstrom (CAREI, 2001; book chapter, in press)                 | Exec. Report; Book Chapter | Approx. 18 000 | grades 9-12                              | Not known   | Minneapolis School District                   | Self-report (Wolfson & Carskadon, '98)  | Attendance, enrollment, grades from school records                                      | SST change: Improved attendance, enrollment, slight improv. grades, & increased TST  |
| <b>Sleep, classroom performance, and other outcome measures</b> |                            |                |  |             |   |   |   |  |
| Horn & Dollinger (J School Psychol, 1989)                       | Peer Rev. Journal          | 239            | grades 6 & 7 (M = 12.0)                  | 49% females | Rural midwestern school                       | Self-report sleep latency, TST, sleep complaints, restedness                                      | Examination grades  | Self-report anxiety scale, vigilance test  |
| Meijer et al. (J Sleep Res, 2000)                               | Peer Rev. Journal          | 449            | grades 7 & 8 9.4-14.4 (M = 11.25)        | 46% female  | 7 schools, Amsterdam                          | Self-report (measure pub. with study) TIB, get up time, BT, quality of sleep scale (alpha = 0.72) | Concentration: (Bourdon-Vos, '92) school funt; School Perception Q. (Van der Wolf, '95) | More restedness assoc. better perf. on no-exam day vs exam-day<br>Sleep quality assoc. school function, particularly achiev. motivation; TIB, BT, get up time not related to school funct. |

school-nights versus a difference of about 1.8 h for the A and B students.

A few studies examined the relationship between sleep/wake patterns and academic performance in older adolescent college students. Trockel and colleagues [15] either interviewed or surveyed a total of 200 randomly selected first-year college students regarding sleep/wake habits, exercise, eating, mood, perceived stress, social support and religious habits. With permission from the participants, they also obtained their GPAs from the university registrar. Of all the variables considered, sleep habits, particularly wake-up times, accounted for the largest amount of variance in grade point averages. Later weekday and weekend wake up times, later weekday and weekend bedtimes, and greater numbers of work hours (paid/volunteer) were associated with lower grade point averages. For each hour of delay in reported average weekday rise time, the predicted GPA decreased by 0.13 on a standard grade scale of 0–4.0. Eating habits, mood, stress, time management, and social support were not associated with these first-year college students' grades. Strength training and study of spiritually oriented material were somewhat correlated with higher grade point averages. According to the authors, the relationship between earlier bedtimes and wake times and higher GPA was the most significant study finding, lending moderate support for the hypothesis that sleep habits account for variance in first-year college students' academic performance [15].

In another recent study of college students, investigators found that short sleepers reported significantly lower overall grade point averages than did long sleepers [16]. The researchers surveyed nearly 150 introductory psychology students regarding their backgrounds, average sleep length, and overall college GPAs. Although there were no age or sex differences, long sleepers ( $\geq 9$  h/night) reported significantly higher GPAs than short sleepers ( $\leq 6$  h/night) (GPA = 3.24 vs 2.74). Grades of average sleepers (7–8 h/night) were not significantly different from those of long or short sleepers. These results support the hypothesis that long sleepers or those who obtain more total night time sleep tend to report better or higher grades (GPAs) than short sleepers.

These studies demonstrate a number of strengths and shortcomings. It is striking that although a cause-and-effect relationship has not been established, these studies collectively suggest that self-reported diminished total sleep quantity, delayed and/or erratic sleep schedules, later weekend rise times, longer sleep

latencies, and increased daytime sleepiness contribute to older adolescents' poor school performance for preadolescents through first-year college students. Moreover, although these studies relied on a variety of measures for assessing both sleep patterns and academic grades; their overall results are comparable. On the other hand, there are several shortcomings. First, data are difficult to compare across studies because of the differences in sleep variables, grading systems, and lack of information on the participants' backgrounds, living situations, and school environments. Second, a few of these studies were published only in an abstract format, which limited the amount of detail on methods, measures, background on participants and so forth [10, 12]. Third, some of the studies provided minimal information on how school performance or achievement was measured or operationally defined [11, 13].

### School start and phase preference

A small number of studies has approached the issue of sleep and school performance from a school schedule or circadian rhythm perspective. These studies compared sleep/wake patterns and academic performance for early versus late starting schools or for students with a morning-type phase preference versus those with an evening-type phase preference.

In a small-scale study, Allen [17] compared 12th graders with a 7:40 am school start time ( $n = 72$ ) to 12th graders attending a high school with an 8:30 am start ( $n = 30$ ). These students completed a sleep-wake questionnaire in human behavior class. Items covered school and weekend sleep patterns, work hours, average grades, weekend social habits, and alcohol use. Compared to students attending the later starting school, the students with the earlier start time reported shorter school-night total sleep times, more sleep problems, and sleeping in later on weekends. For all students, later weekend bedtimes were associated with poorer grades, later weekend parties, and later employment hours. The investigators pointed out that 15% of students reporting highest grades (A–B+) described going to bed after 2:30 am on weekends, whereas 35% of the students with "average grades" reported such late bedtimes. Although this brief report indicated a relationship between sleep patterns and school performance, average grades did not differ for students with early versus late school start times [17].

In the report of Epstein and colleagues [18] school start times, sleep habits, and performance were examined in a large number of Israeli children and teenagers ( $n=6495$ ) from 40 schools: 2764 were elementary school students; 607 were attending junior high schools; and 3122 were in high schools. These investigators reported significant correlations of reported total sleep time with ability to concentrate in school, tendency to doze off during classes, and frequency of school tardiness. In another study reported by the same researchers [19], just over 800 Israeli fifth graders were surveyed. These preadolescents attended schools with starting times that ranged from 7:10–8:30 am. The investigators compared those that started at least two days per week at 7:15 am or earlier with those that started regularly at 8:00 am. Mean total sleep times of the students attending the schools with early start times were significantly shorter than those students at the later starting schools. The former group expressed more frequent complaints of daytime fatigue and sleepiness throughout the school day, a greater tendency to doze off in class, and attention/concentration difficulties in school. It is noteworthy that these complaints were not associated with their total sleep times. Moreover, average school night total sleep time for the early group was 8.7 vs 9.1 h for the later-starting group. Students with the earlier school start also reported feeling most tired during their first class of the day. Epstein and colleagues concluded that early start times negatively influence sleep and, therefore, have a negative impact on daytime functioning in school [19].

Wahlstrom and colleagues [20] also examined differences among districts with different high school start times. These researchers compared sleep habits and daytime functioning of high school students ( $n=7168$ ) from three school districts in the Minneapolis/St Paul, Minnesota area. District A started classes each day at 8:30 am, whereas Districts B and C started at 7:25 am and 7:15 am, respectively. Similar to Wolfson and Carskadon [14], they found that students who get better grades tend to go to bed earlier and get more total sleep on school nights. This was particularly true for A and B students versus D/F students. Furthermore, high school students in District A reported similar bedtimes to students in Districts B and C; however, they reported getting up about one hour later and obtaining about an hour more sleep on school nights ( $p < 0.0001$ ). Weekend sleep habits did not differ among students in these districts. Students in District A reported fewer sleep/behavior problems than students in the other two districts. Finally,

District A students reported that they earned higher grades than did District B and C students.

Other studies have examined at the relationship between circadian phase preference (morningness/eveningness) and school functioning. Cortesi and colleagues [21] utilized a self-report sleep habits questionnaire [14] and a morningness/eveningness scale (not defined), to assess these issues in just over 3000 Italian teenagers. Evening types reported poorer school achievement and a greater tendency to fall asleep in school. Also, evening types reported later bedtimes on school and weekend nights, later rise times, longer sleep latencies, and slept less on school nights (455 vs 481 min), but more sleep on weekend nights (545 vs 520 min). In another abstract report, these investigators [22] also compared sleep patterns and academic performance for late versus early starting schools (8:00 vs 8:30 am) for the same sample of teenagers. Students at the earlier starting school had significantly more irregular sleep schedules, complained of increased daytime sleepiness, used more stimulants, and reported poorer school performance than those at the later starting school. It is noteworthy that these researchers attempted to relate their findings to parents' socioeconomic status (SES), family background, and geographic region; however, it was unclear how these variables were assessed or accounted for in the analyses [22]. They acknowledged that SES was not associated with the students' sleep patterns, but that students from "not intact" families had more irregular sleep patterns.

Another researcher [23] examined delayed sleep phase, sleep loss and academic performance in 211 university students in Australia. Participants were all first-year psychology students who attended a voluntary test-administration session as part of their psychology course experience. The students completed a questionnaire that queried about sleeping times and other sleep habits, frequency of sleep difficulties (e.g., difficulty falling asleep, early morning wakings), and a variety of daytime symptoms (e.g., drug use, napping, depressed mood). Academic performance was operationalized as the final grade in the first-year psychology course, with final exams given at the student's preferred times. This study also attempted to identify students with delayed sleep phase syndrome (DSPS), defined as late lights-out time and/or long sleep-onset latency, little difficulty maintaining sleep, and late wake-up time on weekends [22]. The investigator compared a DSPS group ( $n=35$ ) with two other groups of students, a group who reported frequent or more sleep difficulties ( $n=19$ ) but no

daytime sleepiness, and a control group with no sleep problems selected at random from the remaining sample ( $n=35$ ). Both the control group and the sleep difficulty groups had significantly higher mean final psychology course grades than the DSPS group and did not differ from each other. Lack concluded that the sleep/wake pattern associated with DSPS and chronic insufficient sleep might result in lowered academic performance [23].

The final study that looked at associations as a function of timing issues examined school start times, sleep/wake habits and academic performance. This project was unique because it utilized a naturalistic design to study of the impact of changing school start times in a large metropolitan school district on sleep patterns and school functioning [24, 25]. Wahlstrom and colleagues compared over 18,000 high school students in the Minneapolis School District before and after the district's school start time change from 7:15 am in the 1996–97 school year to 8:40 am beginning with the 1997–98 school year [24, 25]. The researchers compared attendance, enrollment, grades obtained from official school records, and sleep patterns acquired from a self-report survey. The following statistically significant results were reported by the investigators: (1) attendance rates for students in grades 9 through 11 improved over the period from 1995 to 2000; (2) percentage of high school students continuously enrolled in the district or the same school also increased over this time period; (3) grades showed a slight but not statistically significant improvement following the school start time change; and (4) Minneapolis high school students reported bedtimes similar to students in schools that did not change start times and the Minneapolis students obtained an hour more sleep on school nights during the 1999–2000 school year in comparison to students attending high schools that began an hour earlier [24]. The positive impact of the later school start was most prominent in the African American students, who accounted for 40% of the student population [24, 25].

Wahlstrom and her colleagues, whose chief area of expertise is educational policy, acknowledged that comparing grades between schools or districts and within schools across several academic years raises a number of methodological concerns [24, 25]. First of all, the titles of classes differed from school to school, so that comparisons of similar classes were very difficult to make. For example, there were 642 differently named mathematics classes over the five years among the seven high schools. Second, the length

of class periods (four periods of 90 min on the block schedule, versus a 6- or 7-period day) and number of grading periods (semesters versus trimesters) varied markedly from school to school. Third, students in this district tended to be somewhat transient, and the schools kept the grades. Thus, if a student began a semester in one school and then moved at mid-semester to another school, the class entries in the first school could be left blank for the listed courses, with the same student showing up in a different set of classes in the second school. Finally, a number of schools did not have records for some of the students who were supposedly attending that school [24, 25].

Taken together, a few preliminary conclusions may be drawn from these studies regarding the complex relationship between school start time, phase preference, and adolescents' school performance. The studies suggest that self-reported eveningness, delayed sleep schedules, and early school start times seem to be associated with daytime sleepiness, dozing in class, attention difficulties, and poorer academic performance [20–23]. Such conclusions need to be carefully evaluated, however, because study designs, methodologies, measures, study locations, sample sizes, and other factors varied markedly across the studies. Specifically, the following shortcomings need to be examined: (1) school performance and/or attention/concentration levels were not clearly operationalized in several of the studies [17–22]; (2) morningness/eveningness was measured in a few of the studies, but the specific measurement tool is not described [21]; (3) reliability of self-reports in younger children or preadolescents (i.e., 5th–6th graders) is problematic and parent and/or teacher reports might be more accurate for such variables as school performance; and (4) the studies rarely examined other possible mediating and/or moderating variables such as SES, school type, parental involvement, and other background characteristics.

### **Sleep, classroom performance, and other outcome measures**

A few studies have examined aspects of school functioning or performance other than grades in relationship to adolescents' sleep habits. In an atypical study, test anxiety, sleep, and performance were examined middle school students [26]. As part of this study, the researchers measured sleep and anxiety through self-report, vigilance performance on the Digit Symbol Substitution Test, and school performance

with examination grades. Students' performance, sleep behaviors, and anxiety levels were compared on an examination day (high stress) to a day without tests (low stress day). Three test anxiety level groups (i.e., high, moderate, low) were formed based on subjects' responses to the Test Anxiety Scale [27, 28]; the groups did not differ in their reports of sleep complaints. No significant correlations were reported between any of the sleep variables and vigilance task scores on the stress day; however, vigilance scores on the non-stress day were significantly related to the students' ratings of how rested they felt on that morning (i.e., restedness). In other words, reports of greater restedness on the no-test day were associated with better performance on the vigilance task [26]. These findings are difficult to compare with those from studies that focused on sleep patterns and academic grades; however, we included this study because it hinted at complex association between sleep or perceptions of daytime sleepiness and school anxiety. Thus, sleep habits and/or levels of sleepiness might be more significant on a "regular" school day than on days where exams are given, as anxiety and/or motivation might supersede sleepiness in affecting test performance.

Meijer and colleagues focused more on the relationship between sleep/wake patterns and young adolescents' perceptions of their school functioning than on academic achievement [29]. These investigators assessed nearly 450 Dutch young adolescents at several schools. Sleep behaviors were obtained using a self-report questionnaire that included a sleep quality scale (created from questions regarding sleep latency, frequency of wakings, subjective sleep perception); concentration or selective attention was measured by a time-limited pencil and paper test; and children's school functioning was evaluated with the School Perception Questionnaire [30]. The latter measure is noteworthy, as it apparently attempted to assess the young person's own sense of how they are performing at school. Meijer and colleagues found that 43% of these young adolescents had trouble getting up in the morning, 15% complained of sleep problems, and 25% did not feel rested during school; however, neither time in bed nor quality of sleep was associated with differences in concentration [29]. On the other hand, participants who noted having difficulty waking up in the morning reported less motivation to do their best at school; whereas children who reported higher quality sleep and feeling more rested reported greater receptivity to their teacher's influence, a more positive image of themselves as students, and higher motivation

to do their best in school. The authors concluded that quality of sleep has a substantial impact on preadolescents' school functioning such as achievement motivation and student self-image [29].

These two studies of sleep quality, sleep habits and classroom performance in middle school students [26, 29] both found that feeling rested and ease of getting started in the morning were associated with school motivation, performance, and student self-image. On the other hand, variables more reflective of sleep habits (such as time in bed or sleep latency) were not associated with these school factors [26, 29]. Similar to the findings of Epstein and colleagues, Meijer and colleagues also found no association between the length of time in bed and difficulty concentrating and paying attention [19, 29]. These studies indicated that particular moderating and mediating variables (e.g., anxiety levels, school motivation, level of self-confidence, etc.) might influence the complex relationship among adolescents' sleep habits, sleep quality, daytime sleepiness, and school performance.

## DISCUSSION

In the majority of studies described here, the investigators did not take into account other variables that may account for differences in school performance among children and adolescents. Trockel and colleagues, by contrast, examined the influence of sleep habits, exercise, eating habits, mood, perceived stress on first-year college students' GPAs and were able to conclude that certain sleep habits contributed the largest amount of variance in predicting GPAs [15]. Without accounting for the other factors, however, these researchers could not have drawn the same conclusions. The work of developmental psychologists, educators and other social scientists in assessing factors that contribute to differences in school performance have highlighted the importance of a more comprehensive approach than most sleep scientists have used. Likewise, Dornbusch, a distinguished social scientist, recently acknowledged that researchers that study adolescent functioning (e.g., psychologists, sociologists and others) need to examine the impact of sleep on adolescents' deviant behavior, school difficulties, and psychological well-being [31]. In the section below, we discuss some of the past research regarding variables associated with school success, particularly for adolescents.

summarized a consensus from consulting with educators about the use of grades as a measure of school performance [37, 38]. In comparison to intelligence and standardized achievement tests, grades by consensus provide the more appropriate measure of school performance [38]. Thus, although grades, undoubtedly, represent a relatively arbitrary and even subjective assessment by a teacher, the "typical", "usual", or "average" grade is the summation of many judgments about the student's response to the curriculum. Furthermore, grades appear to be more likely to change as a result of learning, because they are more closely tied to a student's curriculum and are a more sensitive measure of learning per se than are achievement tests [42].

The issue of school report versus self-report of grades was examined in over 5,000 high school students [44]. Dornbusch and his colleagues found that self-reported (i.e., on a survey) and school reported (i.e., student transcripts) grades were correlated ( $r=0.79$ ), and there was no tendency for students to overstate or understate grades except for a slight tendency of students near the bottom of the distribution to report better grades [37, 44]. Other studies have supported this finding [45].

A final point that Dornbusch and colleagues make is that it may be useful to adjust average grades based on students' tracks, arguing that adjusted grades better reflect the actual performance of students, since an A in an honors class, for example, usually represents a higher level of performance than the same grade in a basic or remedial course [37]. Others have argued that it is more reliable and, perhaps, more valid to rely on grades reported (by school or student) only for major subjects such as, English, Math, Science, and Social Studies, rather than including other subjects such as, art, music, and physical education [42].

In contrast, some social scientists [34, 46] recommend using achievement tests as a measure of school performance for the following reasons: (1) individually administered tests tend to be more reliable for children with learning problems; and (2) test content is more representative of what was being taught in the schools in comparison to individual teachers' tests. On the other hand, these researchers, themselves, point out that since most students spend considerable time on seat-work assignments, teacher-made tests or essays as opposed to standardized tests, may make just as much sense to evaluate school performance based on these types of tasks (i.e., rely on academic grades) [34, 46].

Other measures, such as graduation, dropout, absenteeism, and tardiness rates may also serve as indexes of school performance, though each taps different aspects of so-called school performance. Thus, graduation rates provide a measure of students satisfactorily completing educational requirements; whereas, absenteeism and dropout rates offer a measure of student participation in classes, and perhaps provide clues regarding interest in learning.

Unmistakably, although the self-report studies of school performance have limitations, the implications of the data that we have just reviewed seem undeniable. Sleep researchers have much to learn from this fairly large and historical body of research on predictors of school performance. In the section below, we outline recommendations for future research.

### **Conclusions and future recommendations regarding sleep and school performance**

Although the current published studies on sleep and school performance have limitations, findings strongly point out that self-reported shortened total sleep time, erratic sleep/wake schedules, late bed and rise times, and poor sleep quality are negatively associated with academic performance for adolescents from middle school through the college years. We note the importance of these findings; however, certain caveats pertain. First, the results of these studies are based almost entirely on the adolescents' self-reports and suffer limitations because data tend to be retrospective and subjective. Although the studies used a variety of measures of both sleep and academic performance, future studies should use multiple sources of measurement within the same study, such as parent and teacher ratings, school record data, standardized test batteries, and sleep laboratory and/or actigraphy recordings. A multi-measure approach will provide a more comprehensive and possibly more reliable assessment than studies conducted, to date.

Second, this review focused specifically on adolescents' sleep and school performance; however, other largely in-lab, experimental studies have examined the impact of sleep deprivation, sleep restriction, and sleepiness on laboratory measures of motor skills, attention, memory, and problem-solving [47, 48]. For example, several studies of children have reported decrements in verbal creativity, attention, and psychomotor performance following either sleep restriction or sleep deprivation [48–50]. Fallone and colleagues

## Hidden confounds in school performance research

Very few developmental periods are characterized by so many changes at so many different levels as adolescence. Risk factors with regard to school failure or changes in school performance seem to increase during early adolescence as students transition from elementary school to junior high or middle school. For example, studies have found a noticeable decline in adolescents' grades as they transitioned into junior high school [32, 33]. This decline may be exaggerated for young adolescents who report erratic sleep/wake schedules, for example. Researchers have tried to understand school performance among both middle school and high school age adolescents from a variety of perspectives such as motivational changes, self-concept, ethnic and social class, parental style and involvement, family structure, teenage employment, stressful life events or multiple life changes, social support/relationships, as well as school environment and size. According to Wigfield and colleagues studies have looked at both the role school environments might play in school performance, a General Environmental Influences Model, or at the relationship between the adolescent's needs and his/her environment, a Person-Environment Fit Model [32].

Studies using the general environmental influences model or design have found that students attending smaller schools or in smaller school districts tend to have higher achievement and more consistent attendance; these findings are particularly strong for lower SES, ethnic minority, and students with prior school difficulties [32, 34, 35]. Higher teacher salaries, greater teacher self-efficacy, and better school facilities have also been shown to have a positive influence on student performance [32, 36]. In several well-cited studies with a total sample size of 7664, Dornbusch and colleagues found that community SES predicted grades for both African American and Non-Hispanic white students as well [37, 38].

The other model examines school performance from the perspective of a person-environment fit. In this context, studies have looked more at how certain aspects of the adolescent's daily functioning (for example, grade, parenting styles, parental involvement, high school employment, sports (exercise) involvement, self-concept, and/or stress) may be associated with school success [38–43]. Most studies from this theoretical approach examine one factor, such as whether student employment hours predicted

grades, while controlling for other factors, such as parents' occupations, education levels, and income.

Briefly, Dornbusch and colleagues found that both authoritarian and permissive parenting styles were negatively associated with grades, whereas authoritative parenting was positively associated with grades, particularly for white students [38]. Other factors, such as sex, age, parent education, ethnic background, and family structure did not influence these findings. Students with pure authoritatively oriented parents reported the best grades, and inconsistent parenting styles were correlated with the lowest grades [38].

Social scientists (i.e., psychologists, educators) have also looked at school performance in relation to family structure and parental participation [39, 40]. One study, for example, found that lack of a parent, either mother or father, increased children's behavioral problems and lowered school performance [40]. However, although children from two-parent households performed significantly better in school than those living in single-mother or single-father homes, the strengths and shortcomings of each situation may affect school performance and behavior differently.

In the last two decades, studies have also reported that long hours of employment and cumulative stressful life events are negatively associated with high school performance [41–44]. For example, Quirk and colleagues surveyed 15,552 students in grades 8–12 regarding employment hours and GPA along with the following control variables: parents' education, occupation, income, ethnic background, and previous school achievement [42]. They found that hour of work accounted for a moderate significant negative effect on high school grades. In particular, students who reported working fewer than 12 h/week earned similar or better grades than their peers who did not work at all. Yet, grades dropped significantly for students who worked 12–35 h/week. Steinberg and colleagues reported similar findings in an earlier study [43].

## Measurement of school performance

Assessment of school performance itself has proved challenging, and social scientists have struggled with the best way of defining and then operationalizing school performance. The construct "school performance" has been variously defined and measured. Dornbusch and colleagues, among the most established adolescent development researchers, have

concluded in their recent review of research on sleepiness and daytime behavior in children that cognitive flexibility and abstract reasoning abilities may be impaired as a result of sleepiness [47]. Evidence of difficulty in other aspects of learning, such as motor skills, memory, and attention is far less consistent [47]. One could argue that verbal creativity, attention skills, and a range of other cognitive and behavioral skills are intricately related to school performance. We recommend that future studies look at sleep/wake patterns, school performance and in-lab measures of attention, verbal creativity, and other tasks in the same sample of adolescents to expand our understanding of the impact of erratic sleep habits and shortened total sleep on overall grades, as well as specific school-related tasks (e.g., learning a second language, English vs math classes, etc.).

Fourth, as emphasized in this review, assessing sleep along with a variety of other variables that influence school performance, such as SES, parent involvement, school size, employment hours, levels of anxiety and motivation, sex, age, and other factors, will provide a more thorough understanding of the mediating and moderating factors that influence the relationship between sleep/wake patterns and school performance and predict academic performance itself.

Fifth, because the studies reviewed here were performed in specific geographic areas and particular school systems, caution should be taken in generalizing the findings. Large-scale, multi-site studies will be important to make such generalizations. Since the studies were cross-sectional, no conclusions about long-term ramifications of inadequate sleep can be drawn. Future investigations need to gather longitudinal data across several weeks, months, as well as years of school performance, behavioral, and sleep data.

Researchers, clinicians, and educators also need to be concerned about the impact of sleep disorders, particularly DSPPS and psychophysiological insomnia, on adolescents' ability to function and achieve in school [51–53]. Insomnia and DSPPS both interfere with an adolescent's ability to fall asleep at night, resulting in increased difficulty with getting up for school in the morning, and reduced sleep. Although clinicians and researchers have concluded that insomnia and DSPPS produce daytime sleepiness, poor academic performance, and behavioral problems, well-designed studies to establish these associations and the impact of interventions are lacking [23, 51–53]. Similarly, studies of young children with sleep apnea and other

sleep disorders that contribute to excessive daytime sleepiness suggest that these children may be at risk for absenteeism and lower academic performance [54].

In conclusion, although self-report data have clear limits, the implications of the studies reviewed here seem unambiguous. Schools, parents, and pediatricians need to take an active role to consider sleep and sleep disorders in the context of academic grades, test scores, absenteeism, emotional difficulties, and other aspects of daytime functioning and adolescent development. Likewise, just as sleep researchers need to consider other factors besides sleep in relation to school performance, behavioral scientists in other fields concerned with adolescent development and school functioning need to add the insights regarding adolescents' sleep into their studies and clinical work.

At a more individual level, clinicians, parents, and teachers need to assess the teen who consistently falls asleep in class, is routinely late or absent from school, and take note that insufficient or ill-timed sleep or a sleep disorder may be involved. In Meehl's well-cited article, "When shall we use our heads instead of a formula?" he argued certain issues cannot be studied with statistical prediction [55]. Undeniably, the best behavioral science research and clinical practice requires shuttling back and forth between innovative theory and practice based hypotheses and subsequent empirical studies [55]. Finally, it is essential for researchers, practitioners, and educators to take interdisciplinary approaches to understanding and promoting the academic, health, and behavioral well being of adolescents—middle school, high school, and college students. Likewise, clinical researchers should develop and evaluate the impact of intervention programs for adolescents that promote earlier bed-times, increased total sleep time, and other sleep hygiene practices on both sleep/wake patterns as well as academic performance. This overall review and recommendations are particularly important at a time when educators, health care practitioners, policy makers, and the general public are focused on increasing students' (particularly teenagers) performance and overall well-being, as well as focused on improving the performance of schools.

### Practice Points

1. Adolescents who report inadequate sleep, irregular sleep patterns and/or poor sleep quality as a group tend to do poorly in school in comparison to other adolescents.

2. Health care practitioners (e.g., physicians, psychologists, nurses, social workers) should carefully assess for sleep disorder(s) and/or poor sleep habits in adolescents who:
  - (a) Consistently fall asleep in class;
  - (b) Are routinely late or absent from school;
  - (c) Are doing poorly academically, particularly without a known or previously diagnosed learning disorder or health problem(s).
3. Health care practitioners should consider insufficient, ill-timed, and irregular sleep when evaluating adolescents for these types of behavior and complaints that may suggest insomnia, delayed sleep phase syndrome, or clinical depression.
4. Adolescents and their parents should be advised that inadequate sleep and irregular sleep schedules might lead to poor school performance.

### Research Agenda

1. Explicit operational definitions of school performance need to be provided when reporting results.
2. Performance outcomes need to be assessed in the context of overall base rates or overall distribution of grades by district and type of school.
3. The relative contribution of sleep patterns to school performance should be examined along with other variables that predict academic performance (e.g., SES, parent education, gender, parent-child relationships (parenting style), marital status, etc.).
4. Studies need to examine students over several weeks with multiple measures of sleep (e.g., parent and self-report or survey and actigraphy) and school functioning (e.g., self-reported grades, school records, and absenteeism rates).
5. Longitudinal studies are needed to evaluate developmental changes and possible sequelae of inadequate sleep over time.
6. The impact of such sleep disorders as insomnia and DSPS on adolescents' school performance and related outcome measures needs to be more thoroughly examined.
7. Assessment techniques and intervention strategies that improve adolescents' sleep habits need to be developed and tested. Evaluation of these programs should include changes in sleep habits, school performance, and other behavioral outcomes.

8. Statistical power, effect-size estimates, and ultimately sample size should be derived based on previous research and theory (e.g., from school performance studies).

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# THE IMPACT OF SCHOOL START TIMES ON ADOLESCENT HEALTH AND ACADEMIC PERFORMANCE

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## REVIEW OF LITERATURE ON ADOLESCENT SLEEP & SCHOOL STARTING TIMES

- There has been a general consensus that American adolescents are not getting enough sleep.
- Studies conducted over a nearly 30 year period have consistently shown only a small fraction of adolescents obtain the 9 or more hours of sleep they require to function at their best. While teenagers are notorious for causing their own sleep difficulties – staying up too late, playing with electronic gadgets, and generally burning the candle at both ends – sleep loss among adolescents is confined primarily to school nights.
- Insufficient sleep time could impair adolescents' learning and development.
- Restricted sleep in adolescents is associated with profoundly impaired learning capacity, increased rates of depression, anxiety, and fatigue, increased risk of suicidal ideation and completed suicide, increased rates of automobile accidents, decreased athletic and motor skills, excessive weight gain, increased likelihood of criminal conduct, risk-taking behaviors, including drug or alcohol use, increased likelihood of physical, psychological, or social difficulties, elevated blood pressure, interference with secondary brain development.
- There is evidence that students could benefit from a late school schedule by having more sleep time.
- Most U.S. high schools schedule classes during the 7 o'clock hour, while melatonin still pressures adolescents to sleep. The vast majority of teenagers attending early starting schools meet the morning bell in a sleep-deprived state.
- The National Institutes of Health and the American Lung Association of New England have identified early school start times as a factor contributing to teen sleep deficiency. Janet Croft, Ph.D., a senior epidemiologist at the CDC, believes that early school start times have a "deleterious impact" and impose "an unrealistic burden" on adolescent students.
- In 1994, physicians began advising school leaders to "eliminate early starting hours for teenager(s)". Sleep experts urged a delay in morning classes until 8:30 a.m., or later, for middle and high school students.
- A widely cited study conducted by Wolfson and Carskadon (1998) in which students self-reported high grades were found to have more sleep time than those who self-reported low grades.
- Students at later starting schools get more sleep, perform better academically, have significantly fewer automobile accidents, report greater motivation and less depression, and experience fewer physical health difficulties
- Multiple factors contribute to sleep deficiency in teens, including electronic devices, jobs, erratic sleep schedules, caffeine, social and school obligations. Restricted sleep, however, is primarily limited to school nights, rather than weekend nights, with students losing up to 2 hours of sleep each night after the start of school.

## THE IMPACT OF SCHOOL START TIMES ON ADOLESCENT HEALTH AND ACADEMIC PERFORMANCE

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- Physicians from the Thoracic Society of Connecticut assembled a task force to both raise awareness and advocate for a change to later start times. According to Dr. Heidi Connolly, Associate Professor of Psychiatry and Pediatric Sleep Medicine at the University of Rochester Medical Center in New York, “Sleep medicine specialists have long known that delaying high school start times helps teenagers sleep better.”
- In 2009, a Rhode Island high school changed start times from 8 a.m. to 8:30 a.m. at the urging of sleep medicine specialist, Dr. Judith Owens. As in Minnesota, fewer depressive symptoms were reported among students following the change. Researchers found this “particularly noteworthy given the relationship between depression and suicidal ideation in adolescents. In addition, students reported feeling more motivated to participate in a variety of activities and were less likely to seek medical attention for fatigue-related concerns. Following the change, students actually went to bed 15 minutes earlier, increasing their nightly sleep total by 45 minutes.”
- There is an economic benefit. Considering this and other evidence, including a seven-year middle school study by Finley Edwards, Ph.D., Brookings Institute economists “conservatively” estimate that when middle and high school start times are delayed “from roughly 8 a.m. to 9 a.m.” student achievement will increase by 0.175 standard deviations, with a corresponding increase in student future earnings of approximately \$17,500 lifetime, at little or no costs to schools; i.e., a 9 to 1 benefits to costs ratio.
- Scientists in Kentucky and Virginia found significantly decreased frequencies of automobile crashes among teens in districts where start times were pushed back an hour or more to 8:30a.m., or later – a significant finding when one considers automobile accidents account for more than one-third of all teen fatalities.
- Careful planning is required in order to successfully delay start times. Adults may be inconvenienced for the benefit of students. Budgets, busing, and politics determine school schedules more often than students’ best interests. Stakeholders often contend delaying school schedules will disrupt sports, jobs, extracurricular activities, and daycare plans.
- Professor of Neurology and Director of the Minnesota Regional Sleep Disorders Center, Dr. Mark Mahowald, notes “Not a single excuse we’ve heard relates to education. None of the excuses have the word ‘education’ in them. We should send kids to high school in a condition that promotes learning rather interfering with it.”
- A point of concern raised by the Center for Disease Control (CDC) and the National Institutes of Health is that the ultimate decision for determining start times will substantially be determined by the whims of local school boards.

# THE IMPACT OF SCHOOL START TIMES ON ADOLESCENT HEALTH AND ACADEMIC PERFORMANCE

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## THE BASICS OF ADOLESCENT SLEEP BIOLOGY AND RELATED RESEARCH

- The great majority of high school students are getting insufficient sleep. The 2011 Centers for Disease Control and Prevention (CDC) Youth Risk Behavior Survey of 15,425 high school students in 50 states and the District of Columbia found that on an average school night, 7.5% obtain optimal sleep (>9 hours), 23.9% report “borderline” sleep (8 hours), and 68.6% report insufficient sleep (<8 hours). The 2011 National Sleep Foundation poll found only 14% of teenagers between the ages of 13 and 18 report getting 9 or more hours of sleep on weeknights.
- A 2009 study of 384 students from three Midwest high schools found 91.9% slept less than 9 hours on school nights, with 10% sleeping less than 6 hours each night. The 2007 CDC Youth Risk Behavior Survey found that nationwide, on an average school night, 68.9% of students reported sleeping less than 8 hours, 23.5% reported getting 8 hours, and 7.6% reported getting 9 or more hours. The 2006 National Sleep Foundation poll found only one in five adolescents getting the recommended 9 or more hours of sleep per night.
- In 2008 Norwalk Hospital sleep experts noted that the “often serious impact of this chronic under-sleeping is now evident in both high school and middle school students. This pattern of rising sleep debt during the week followed by weekend catch-up still leaves most teens sleep-deprived by an estimated 10 hours per week.” In 2009, writing for the journal, *Developmental Neuroscience*, researchers again commented, “Sleep deprivation among adolescents is *epidemic*”.
- “Sleep deprivation among adolescents appears to be, in some respects, the norm rather than the exception in contemporary society. Because of a multitude of intrinsic and environmental factors, adolescents are particularly vulnerable to disturbed sleep and are one of the most sleep deprived age groups in the country.” It has been shown that “adolescents’ increased sleepiness is similar to the clinical level of sleepiness presented by patients with severe sleep disorders.”
- For most U.S. secondary students, circadian biology collides with early morning classes five days a week, leaving many “pathologically sleepy”.
- Most U.S. high schools begin before 8 o’clock while the sleep inducing hormone, melatonin, still pressures adolescents. The circadian system manages a sleep/wake cycle in adolescents which runs from approximately 11 p.m. to 8 a.m. The sleep pressure rate, or homeostatic drive - the biological trigger that causes sleepiness - slows down in adolescence. “There is clear evidence for a phase shift during adolescence, with adolescents going to bed later and rising later than children. This phase shift is largely biological, with adolescents typically unable to fall asleep at earlier times.”
- “The vast majority of adolescents do not get enough sleep. Research has shown that the average teenager needs 9 to 9-1/4 hours of sleep a night. This is not all that much less than school-aged children need. However, the average amount of sleep that teenagers get is about 7 hours on school nights. (Mindell & Owens, *Clinical Guide to Pediatric Sleep: Diagnosis and Management of Sleep Problems* (Lippincott Williams & Wilkins, 2<sup>nd</sup> ed. 2010, p. 258).

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- Professor of Neurology and Director of the Minnesota Regional Sleep Disorders Center, Mark Mahowald, explains: "All of the research that has been done shows that older adolescents need more sleep than younger ones. They fall asleep later and wake up later to get the sleep they need. Despite these two facts, almost all districts start the senior high schools first. We're sending them to school *during the last one-third of their sleep cycle*. It's comparable to adults getting up at 3 a.m. or 4 a.m."

## ADOLESCENT CIRCADIAN TIMING, RESTORATION & STRESS

- Recent studies demonstrate "adolescent changes in sleep (delayed sleep phase and disrupted sleep) are evident prior to the bodily changes puberty". (Wolfson & Richards, Oxford Univ. Press., El Sheikh ed. 2011), p. 268). "Young people have special needs during adolescent development that are related directly to their intrinsic sleep cycles." The sleep pressure rate, or homeostatic drive – the biological trigger that causes sleepiness – slows down in adolescence. Homeostasis relates to the neurobiological need to sleep; the longer the period of wakefulness, the more pressure builds for sleep and the more difficult it is to resist.
- Inadequate exposure to short-wavelength (blue) light further delays the adolescent sleep/wake cycle, pushing back the onset of melatonin by about six minutes for each morning light-deprived day. According to Mariana Figueiro, Ph.D., Assistant Professor and Program Director at Rensselaer Polytechnic Institute's Lighting Research Center, "As teenagers spend more time indoors, they miss out on essential morning light needed to stimulate the body's 24-hour biological system which regulates the sleep/wake cycle."

The problem is that today's middle and high schools have rigid schedules requiring teenagers to be in school very early in the morning. These students are likely to miss the morning light because they are often traveling to and arriving at school before the sun is up or as it's just rising. This disrupts the connection between daily biological rhythms, called circadian rhythms, and the earth's natural 24-hour light/dark cycle" explains Figueiro.

- "Sleep...helps to restore both mind and body. The body's engines are able to slow down and cool off when we sleep, decreasing the metabolic processes, heart rate, respiration, digestion, and body temperature. Sleep can also be a time of increased healing or, in children, a time of accelerated growth." (Abaci, Take Charge of Your Chronic Pain: The Latest Research, Cutting-Edge Tools (Globe Pequot Press 2010) p. 241). Deep sleep coincides with the release of growth hormone in children and your adults. Sleep seems to be particularly important during the periods of brain maturation. (Across species, maturing individuals sleep more than fully mature individuals.)
- "Adolescent sleep systems appear to become more vulnerable to stress at a time when social turmoil and difficulties are often increasing." Restricted sleep and interrupted circadian timing, discussed *infra*, serve as environmental/physiological stressors in humans. (Wise, Hopkin, & Garland, Handbook of Aviation Human Factors (CRC Press 2<sup>nd</sup> ed. 2009) p. 18-3) Sleep loss means sustaining wakefulness longer which stresses the body, leading to "additional problems". "Prenatal development, infancy, childhood and adolescence are times of increased vulnerability to stressors. The presence of stressors during these critical periods can have prolonged effects, such as sustained cacostasis (defective homeostasis, dyshomeostasis, distress) that can last the entire lifetime of an individual."

# **THE IMPACT OF SCHOOL START TIMES ON ADOLESCENT HEALTH AND ACADEMIC PERFORMANCE**

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- Most districts set the earliest starting time for older adolescents and the latest starting time for younger children. “Ironically, the school starting time moves earlier as children’s grade advances. Although school starts earlier, children cannot adjust their bedtime accordingly, and this could result in sleep deprivation. Subsequently, they are sleepy in the morning and become more alert in the afternoon when school is almost over.” (Cardinali, Chronoeducation: How the Biological Clock Influences the Learning Process, published in *The Educated Brain: Essays in Neuroeducation* (Batro, Fisher, & Léna, edit., Cambridge Univ. Press 2008) p. 121). “Increasing societal demands promoted by a 24/7 culture over the past three decades have contributed to even earlier school start times for both middle and high school students.”
- Early rise times also interrupt a critical sleep phase. “Getting adequate dream (rapid eye movement ([REM]) sleep is essential to perceptual, cognitive, and emotional processing. Selective REM sleep deprivation has been demonstrated to cause symptoms of irritability and moodiness, as well as problems with memory. The issue of under-sleeping adolescents takes on added significance when one considers that waking up too early costs the sleeper mostly REM sleep which predominates during the last two to three hours of a night’s sleep.”

In REM sleep, many parts of the brain are as active as at any time when awake. One study found that REM sleep affects learning of certain mental skills. People taught a skill and then deprived of non-REM sleep could recall what they had learned after sleeping, while people deprived of REM sleep could not. Associate Professor of Psychology Avi Sadeh, a leading authority in this field, has concluded that in teens “A loss of one hour of sleep is equivalent to [the loss of] two years of cognitive maturation and development.” Harvard Professor of Sleep Medicine Susan Redline, M.D., M.P.H., notes that 8 a.m. classes begin too early for adolescent students to obtain sufficient sleep and serve to interrupt REM sleep.

- In most school districts, little has changed since a 2005 study published in “*Pediatrics*”, the official Journal of the American Academy of Pediatrics, observed, “School schedules are forcing [adolescents] to lose sleep and to perform academically when they are at their worst.”

## **ACADEMIC PERFORMANCE**

- Sleep loss is associated with “brief mental lapses in attention during simple tasks that can be partially offset by increased effort or motivation”. Tiredness and fatigue, however, tend to diminish motivation, particularly for tasks perceived as boring or tedious. Sleep deprivation can “sometimes mimic or exacerbate symptoms of ADHD (attention deficit/hyperactivity disorder), including distractibility, impulsivity, and difficulty with effortful control of attention.” There is also evidence that sleep deprivation has marked influences on the ability to perform complex tasks or tasks that require attention in two or more areas at the same time.
- Memory consolidation, long-term recall, and retrieval, particularly of novel material, are all affected by sleep restriction. “Installing new memories – i.e., learning – clearly benefits from, if not depends upon, intervals of normal sleep.” “No getting enough sleep may result in problems with attention, memory, decision-making, organization, and creativity, all of which are clearly important for success in school.” (Mindell & Owens, *Clinical Guide to Pediatric Sleep: Diagnosis and Management of Sleep Problems* (Lippincott Williams & Wilkins, 2<sup>nd</sup> ed, 2010) p. 258).

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- A 2010 meta-analysis (statistical method combining different study results) of 61 studies found poor sleep quality, insufficient sleep and sleepiness significantly associated with worse school performance among students 8-18 years of age.)
- A 2007 study led by Holy Cross Professor of Psychology Amy Wolfson compared two New England middle school with different start times (7:15 a.m. vs. 8:37 a.m.). "Previous research demonstrated that high school students benefit when school start times are delayed by over one hour. In particular, Wahlstrom (2002) found that attendance rates improved, continuous enrollment remained the same or increased, grades showed slight improvement, and students reported bedtimes similar to students in school that did not change start times when obtaining one more hour sleep on school nights.

The present study adds to the field by demonstrating that middle school students are also at an advantage when school start times are delayed. Results reveal that seventh and eighth graders attending an early starting middle school are obligated to wake up earlier in the morning to attend school and are not compensating by going to bed earlier through the school year. As a result, these young adolescents are getting significantly less sleep than their peers at a later starting school and report more irregular weekly sleep patterns, increased daytime sleepiness, and more sleep-wake behavior problems.

The seventh and eighth graders at the early starting middle school obtained about  $\frac{3}{4}$  hour less sleep each night, which amounts to about 3.5 hours less sleep over a 5-night school week. Furthermore, after students had been on their school schedules for over 6 months, those at the early starting school reported more sleep-wake behavior problems, raising questions about the longer range negative implications of early start times for young adolescents. In addition to the sleep deficit, school records indicated that students at the earlier starting school were tardy four times more frequently, and eighth graders at the earlier starting school obtained significantly worse average grades than the eighth graders at the comparison later starting school."

## **PSYCHOMOTOR PERFORMANCE/AUTOMOBILE ACCIDENTS**

- "Sleep deprivation, whether from disorder or lifestyle, whether acute or chronic, poses significant cognitive risks in the performance of many ordinary tasks such as driving and operating machinery." (Jeffrey S. Durmer, M.D., Ph.D., Assistant Professor, Department of Neurology, Emory University School of Medicine; David F. Dinges, Ph.D., Professor of Psychology in Psychiatry, Associate Director, Center for Sleep and Circadian Neurobiology, University of Pennsylvania School of Medicine.
- "Both motor and mental acuity suffer when we are sleep deprived, which can lead to dangerous human errors and accidents. Studies done on test subjects with occupations associated with sleep deprivation – including pilots, truck drivers, and medical residents – typically show a greater risk for fatigue-related mistakes and crashes. Accidents related to lost lives and billions of dollars in costs." (Abaci, Take Charge of Your Chronic Pain: The Latest Research, Cutting Edge Tools, (Globe Pequot Press 2010) p. 241)

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- There is increasing evidence correlating early start times with higher crash rates among teen drivers. In 1999, school districts in Lexington, Kentucky delayed start times for high school students county-wide by one hour to 8:30 a.m. Average crash rates for teen drivers in the county study in the 2 years after the change in school start time dropped 16.5%, compared with the 2 years prior to the change, whereas teen crash rates for the rest of the state increased 7.8% over the same time period. Researcher concluded that “allowing adolescents to sleep more on school nights by delaying the start of school not only results in them sleeping more, but also may have a measurable positive effect on their driving safety”. In reviewing the study, John Cline, Assistant Clinical Professor of Psychiatry at the Yale School of Medicine, commented, “Given the danger posed to young people from car accidents this is a strong reason in itself to change school start times.”
- A 2011 study published in the Journal of Clinical Sleep Medicine found that in 2008, the teen crash rate was about 41% higher in Virginia Beach, Virginia, where high school classes began at 7:20-7:25 a.m., than in adjacent Chesapeake, Virginia, where classes started at 8:40-8:45 a.m. Although a cause and effect relationship has not been established, the Virginia study associates early start times with increased teenage car crash rates. “We were concerned that Virginia Beach teens might be sleep restricted due to their early rise times and that this could eventuate in an increased crash rate,” said lead author Robert Vorona, M.D., Associate Professor of Internal Medicine at Eastern Virginia Medical School in Norfolk, Virginia.

## **EXCESSIVE WEIGHT GAIN**

- A 2010 CDC study published in the Journal of the American Medical Association reports that the rate of obesity in U.S. adolescents between the ages of 12 and 19 years was 18.1 percent in 2007-2008. The authors noted that the prevalence of high body mass index in childhood has remained steady for 10 years and has not declined despite prevention efforts.
- Overweight children and adolescents tend to have reduced REM sleep. Although a recent study suggests otherwise, Dr. Redline and other researchers surmise sleep loss may be the missing link in understanding why diet and exercise obesity interventions fail.
- Harvard Professor of Nutrition and Epidemiology Frank Hu observes that there is a close relationship between dietary habits and sleep habits. Sleep is as important as diet and exercise. Sleep deprivation serves to increase production of the appetite-stimulating hormone, ghrelin, sending a signal to the brain to eat, particularly high calorie, high sugar-content foods. By contrast, restricted sleep diminishes the production of leptin, a hormone which suppresses appetite. Production of a third hormone, cortisone, is increased by sleep loss, elevating heart rate and blood pressure. Chronic elevation of cortisone levels increases the risk of weight gain and obesity, with the latter being particularly dangerous for type 2 diabetes and cardiovascular disease.

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## **DELAYING SCHOOL START TIMES – BENEFITS, COUNTERPOINTS, OBSTACLES, AND SOLUTIONS**

- Scientists from the Centers for Disease Control and Prevention (CDC) report, “Delaying school start times is a demonstrated strategy to promote sufficient sleep among adolescents.” In some districts, however, implementing the change to later start times may be a challenging undertaking. The National Sleep Foundation recognizes eight potential obstacles to adjusting school schedules and proposed possible solutions for each problem.
- Transportation is the first obstacle noted. Fredonia State College Associate Professor Charles Stoddart observes, “The tail of transportation wags the dog of the educational system.” The National Sleep Foundation proposes “flipping” the schedules of primary and secondary school children to address transportation since young children can rise early without difficulty, provided they get to bed early enough to ensure the 10-11 hours of sleep they need. However, in discussing obstacle 3, “Other Students and Programs,” the Foundation appears to challenge its own advice, noting, “Research is lacking on the effect of school start times on younger students so it is hard to justify their early start.”
- As previously observed, even pre-adolescent fifth grade students reported significant sleep deprivation when a start time of 7:10 a.m. was imposed. Mild sleep loss produces marked deficits in cognitive development and functioning in school-age children. While sleep scientists report that elementary students are biologically able to begin school by 7:30 a.m., consideration must be given to the effects of long bus rides, and care must be taken to ensure young children will not be left to await transport in darkness.
- University of California and U.S. Air Force Academy economists found a later start time of 50 minutes “has the equivalent benefit as raising teacher quality by roughly one standard deviation. Hence, later start times may be a cost-effective way to improve student outcomes for adolescents.”
- School personnel will sometimes oppose the change due to concerns they may have to commute during peak traffic or may have less time with their families. The remaining obstacles or objections to later school scheduling include resistance to change, concerns that students will be in school too late in the day to reasonably participate in sports, jobs, internships, and other extracurricular activities; daycare plans being interrupted, and parents failing to address proper sleeping hygiene with their children.
- Certainly, parents should ensure reasonable bedtimes, impose limits on technology use, and encourage exercise in children to help them get the sleep they need. “We can also help teenagers gain control over their own sleep patterns by teaching sleep and circadian principles in middle and high school health education. Minimizing exposure to light at night, as well as reducing computer or TV usage immediately before bedtime can naturally advance circadian phase. Similarly, incorporating outdoor morning activity into a teenage schedule can reduce trouble falling asleep at night”.

# **THE IMPACT OF SCHOOL START TIMES ON ADOLESCENT HEALTH AND ACADEMIC PERFORMANCE**

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- Brookings Institute economists propose districts “consider installing lights for athletic fields that allow students to practice later in the day. While this would certainly be an additional expense, back-to-the-envelope calculation suggests that the benefits of later starting times would outweigh the costs. Officials of the Ann Arbor Public Schools, for example, estimate that it costs roughly \$110,000 to erect lights for an athletic field, and \$2500 annually to operate such lights. Even if a district had to construct and maintain multiple lights at multiple high schools, this investment certainly seems worthwhile compared with the estimated \$17,500 per student benefit of later start times.”
- There have been few counterpoints to the literature produced by sleep researchers and physicians. In 2006, school officials in the Blue Valley School District in Overland Park, Kansas, developed a summary of the literature and while agreeing that adolescents are not getting sufficient sleep and acknowledging that this will impact academic achievement also posited that it is unclear whether student academic achievement will improve along with a later school schedule and that a solid research base concerning the relationship between sleep and learning has not been established. They suggested that practitioners are not prevented from scouting for ways to ameliorate the sleep problems identified in the cumulative survey data. They also suggested that a longer delay does not necessarily correspond to a greater gain in sleep time.

## **RESPONSES TO OBJECTIONS**

- In 2011, scientists writing for the *Journal Educational Researcher* responded to the remaining objections to later start times:
  - “Many who oppose changing school start times cite the disruption of extracurricular activities as a prohibiting factor. Some school boards have successfully implemented a start time change without disrupting extracurricular activities – and, ironically, without having to schedule after-school activities before school – simply by scheduling events later. In fact, results from the Minneapolis study show that later start times did not significantly affect student participation in after-school activities (Center for Applied Research and Educational Improvement, 1998b). The only problem was that some children were pulled out of class early for away-from-school sporting events (e.g., Center for Applied Research and Educational Improvement, 1998a; National Sleep Foundation, 2005e).
  - Perhaps the most important consideration is that the schools have successfully delayed school start times with minimal complications had adequate time to prepare, which they spent engaged in research, policy analysis, and a healthy discourse with the public. However it should be noted that, in any school district where the start times are changed, it is likely that those directly and indirectly involved in the school system will need to make some degree of sacrifice for the benefits of the students. The inconvenient consequences of changing school start times can be attenuated. There is evidence that with adequate planning and preparation, school boards have been able to delay school start times at acceptable monetary cost (given the enormous potential payoff) and tolerable disruption of community functioning.”
- Some parents and school administrators, however, simply aren’t persuaded by the scientific evidence, or that delaying start times would make a positive difference. When asked about

## THE IMPACT OF SCHOOL START TIMES ON ADOLESCENT HEALTH AND ACADEMIC PERFORMANCE

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adjusting school schedules to comport with adolescent phase delay, former San Mateo County Superintendent of Schools Floyd Gonella, Ed.D., responded, "Trying to adjust school times to sleep patterns has no validity. And even if it does, scientific facts come out and three days later, there's another study countering that." (Edmond Burnes, principal of Battery Creek High School, said he's not convinced delaying start times would have much effect on students at "his school". Mr. Burnes explained that the research with which he was familiar involved different demographics than those of Battery Creek.)

- In the Preface to the Stanford Sleep Book, Professor William Dement notes the "stunning truth" of this observation by former United States Senator Mark Hatfield: "America is a vast reservoir of ignorance about sleep, sleep deprivation and sleep disorders." As Holy Cross Professor of Psychology Amy Wolfson points out, "Although sleep consumes approximately one-third of our lives (50% at early school age), it is often ignored by developmental psychologists, pediatricians, educators, and others who devote their lives to working with children and adolescents. For example, sleep is rarely mentioned in textbooks on adolescent development, child-adolescent sleep topics are infrequently presented at the Society for Research on Child Development meetings (.3% of presentations at the 1995 biennial SRCD meeting), and pediatricians get very little training in sleep medicine." (CAREI Director Kyla Wahlstrom suggests that "pairing the growing body of medical research with the educational outcomes seems to be the logical path to argue for changing starting times.)

(References and additional resources can be found at <http://schoolstarttime.org/endnotes/>)

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## Sleep in Adolescents (13-18 Years)

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### What to expect

Adolescents are notorious for not getting enough sleep. The average amount of sleep that teenagers get is between 7 and 7 ¼ hours. However, they need between 9 and 9 ½ hours (studies show that most teenagers need exactly 9 ¼ hours of sleep). Teenagers do not get enough sleep for a number of reasons:

- **Shift in sleep schedule.** After puberty, there is a biological shift in an adolescent's internal clock of about 2 hours, meaning that a teenager who used to fall asleep at 9:00 PM will now not be able to fall asleep until 11:00PM. It also means waking 2 hours later in the morning.
- **Early high school start times.** In most school districts, the move to high school is accompanied by an earlier school start time. Some high schools start as early as 7:00 AM, meaning that some teenagers have to get up as early as 5:00 AM to get ready for and travel to school.
- **Social and school obligations.** Homework, sports, after-school activities (often occurring during the evening), and socializing lead to late bedtimes.

As a result, most adolescents are very sleep deprived. Sleep deprivation will impact on many aspects of your teenager's functioning:

- **Mood.** Sleep deprivation will cause your teenager to be moody, irritable, and cranky. In addition, she will have a difficult time regulating her mood, such as by getting frustrated or upset more easily.
- **Behavior.** Teenagers who are sleep deprived are also more likely to engage in risk-taking behaviors, such as drinking, driving fast, and engaging in other dangerous activities.
- **Cognitive ability.** Inadequate sleep will result in problems with attention, memory, decision making, reaction time, and creativity, all of which are important in school.

- **Academic performance.** Studies show that teenagers who get less sleep are more apt to get poor grades in school, fall asleep in school, and have school tardiness/absences.
- **Drowsy driving.** Teenagers are at the highest risk for falling asleep at the wheel. Drowsy driving is the most likely to occur in the middle of the night (2:00 to 4:00 AM), but also in mid-afternoon (3:00 to 4:00 PM).

### How to help your teenager get enough sleep

- **Maintain a regular sleep schedule.** Your teenager should go to bed and wake up at about the same time each day. Her sleep schedule should also ensure adequate time in bed.
- **Avoid oversleeping on weekends.** Although catching up on some sleep on the weekends can be helpful, sleeping in until noon on Sunday will make it hard for your teenager to get back on a school schedule that night.
- **Take early afternoon naps.** A nap of 15-20 minutes in the early afternoon can be beneficial.
- **Turn off televisions, computers, and radios.** Television viewing, computer-game playing, internet use, and other stimulating activities at bedtime will cause problems falling asleep.
- **Avoid caffeine, smoking, alcohol, and drugs.** All of these cause sleep problems.
- **Contact your teenager's doctor.** Speak to your adolescent's physician if she has difficulties falling asleep, snores, or seems excessively sleepy during the day.

Adapted from: Mindell JA & Owens JA (2003) A Clinical Guide to Pediatric Sleep: Diagnosis and Management of Sleep Problems. Philadelphia: Lippincott Williams & Wilkins.

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• Sleep in Adolesce...

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# Sleep and Adolescents

Principals should be aware of the importance of adequate sleep and the consequences of sleep deprivation on students' mental health, behavior, and school functioning.

By Peg Dawson

**F**irst-period English class, 7:40 a.m. Most of the ninth-grade students stare glassy-eyed at their teacher. Two lay their heads on the desk. Another comes in late. One is absent but arrives during second period.

This scenario is all too common in secondary schools throughout the United States. In most cases, it is less the result of disinterested students or a boring teacher than the symptoms of chronic sleepiness. Lack of sleep is associated with academic and behavior problems, tardiness and absenteeism, reduced alertness, and heightened irritability. Sleep researchers suggest that between 15% and 30% of all children may have a sleep disturbance at some point during childhood (Kahn et al., 1989), and some estimates indicate that between 33% and 75% of all adolescents have sleep problems (Morrison, McGee, & Stantan, 1992; Strauch & Meier, 1988). To put this in perspective, the prevalence rate for attention deficit hyperactivity disorder (ADHD) is conservatively estimated to affect 3%–5% of children (Barkley, 1998) and the Childhood Asthma Foundation (2004) reports that up to 20% of children may have asthma.

## Normal Sleep Patterns

Sleep is broadly classified into two types: rapid-eye-movement (REM) sleep and non-REM sleep (NREM). Cycling through all of the sleep stages for an adequate amount of time is essential to being fully rested. NREM sleep consists of four stages that range from drowsiness to deep sleep. In the early stages (I and II), individuals awake easily and may not even realize that they have been sleeping. In the deeper stages (III and IV), waking is difficult. When awakened, individuals in stages III and IV may feel disoriented and confused. In NREM sleep their muscles are more relaxed than when awake. Although the sleeper in stages III and IV is able to move, this doesn't happen because the brain is not sending signals to the muscles to move.

REM sleep refers to active sleep, which is when dreaming occurs. During REM sleep, the breath and heart rate become irregular, the eyes move rapidly back and forth under the eyelids, and body temperature is impaired so a sleeper does not sweat when hot or shiver when cold. Below the neck, however, the body is essentially paralyzed because the nerve

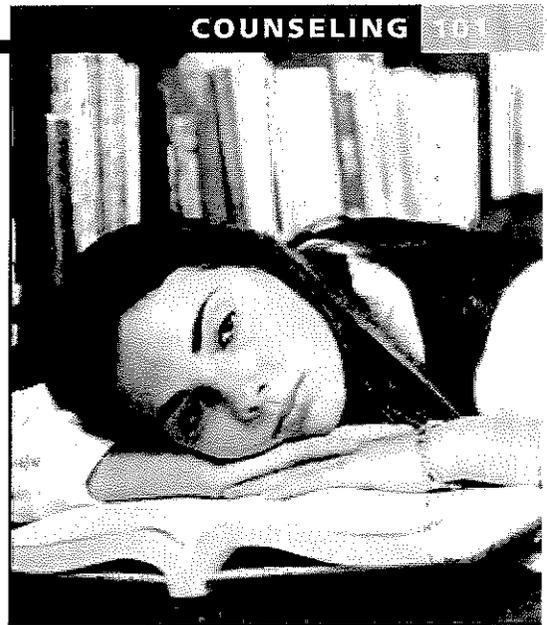
impulses to the muscles are blocked.

Both REM and NREM sleep states develop before birth. Sleep cycle patterns and the amount of sleep needed changes from infancy to childhood, but at the age of four, most children sleep 10 hours a night and cycle through sleep patterns much like those of adults.

## Adolescent Sleep Patterns

Adolescent sleep patterns deserve particular attention because of their potential to affect school performance. Adolescents typically get significantly less sleep than younger children, not because they *need* less sleep but because their schedule and biorhythms impede adequate sleep. Researchers studying the optimal sleep periods of adolescents have found that under controlled conditions (e.g., with no clocks and lighting cues), adolescents typically sleep nine hours a night (Carskadon, 2002). Although research indicates that adolescents require at least as much sleep as they did as pre-teens, 8.5–9.25 hours per night, fewer than 15% of adolescents report that they sleep at least 8.5 hours on school nights and more than 25% report that they get less than 6.5 hours of sleep on school nights (National Sleep Foundation, 2000). Thus, a large number of adolescents are constantly coping with "sleep debt" during the school year.

STOCK PHOTO IMAGE



*Peg Dawson is a psychologist on the staff of Seacoast Mental Health Center in Portsmouth, NH, and is a past president of the National Association of School Psychologists and the immediate past president of the International School Psychology Association. "Counseling 101" is provided by the National Association of School Psychologists ([www.nasponline.org](http://www.nasponline.org)).*

With the onset of puberty, adolescents begin to experience a sleep-phase delay in their biological clock (i.e., circadian rhythms) and develop a natural tendency to fall asleep later in the evening and wake up later in the morning. Even adolescents who are sleep deprived tend to feel alert in the evening, making it more difficult for them to go to bed at a reasonable hour. Sleep is triggered by the release of melatonin, a natural body hormone. Toward dawn, melatonin shuts off as the hormone cortisol increases, signaling the individual to wake up. The pattern and timing of melatonin secretion makes it hard for adolescents to fall asleep and wake up at the times necessary to get enough restful sleep. Schools with start times before 8:30 a.m. place students at a disadvantage in terms of arousal and alertness, not only for early morning classes but also throughout the day because adolescents' biological rhythms are out of sync with typical school routines.

### Disturbances and Disorders

In addition to "normal" sleep deprivation, sleep disorders can have serious consequences for children and adolescents. Although some sleep disturbances are mild, fairly common, and relatively easy to treat, others may be more stubborn or an indication of potential physical problems that could have long-term consequences if left untreated. Among adolescents, the most common sleep disorder is *delayed sleep-phase syndrome*, which affects an estimated 7% of the adolescent population. It can be difficult to diagnose because the symptoms can mimic the typical sleep patterns of adolescents. The person's sleep, or circadian, rhythm is interrupted, making it difficult to fall asleep at a reasonable hour (sleep onset may be delayed until 2:00 to 4:00 a.m.) and wake up in the morning. Treatment may include light therapy (exposure to bright light in the morning), chronotherapy (gradually

advancing the adolescent's sleep schedule one hour per night until a normal routine is achieved), a consistent sleep schedule, and a short-course of sedative medication to help achieve a new schedule. In some cases, it may be necessary to adjust an adolescent's school day to a later start.

Other sleep disorders, far less common in adolescents, include night terrors, sleep walking, nighttime bedwetting, sleep-onset anxiety, obstructive sleep apnea, and narcolepsy. If administrators become aware of students experiencing symptoms of sleep disturbance, a consultation with the school nurse is advised to determine the need for a medical evaluation to rule out sleep disorders.

### Recognizing Sleep Disorders

Side effects associated with sleep disturbances or deprivation are likely to show up in school. In addition to excessive sleepiness, tardiness, and academic and behavior problems, symptoms often include inattention, irritability, hyperactivity, and impulse control problems. Therefore, it is important for educators to screen for sleep problems when concerns exist about a student's attention or behavior problems. In-school screening might take the form of a diagnostic interview with the student's parents that is conducted by the school psychologist or social worker. A diagnostic interview should include questions about student's normal sleep patterns (including bedtime routines, typical bedtime, and wake time on school days and weekends) questions about whether the child has trouble falling asleep or staying asleep, and questions about the frequency of nightmares. Sleep disorders are generally diagnosed by a pediatrician or a sleep specialist. Because not all pediatricians recognize the variety of sleep problems that children and adolescents experience, it may be helpful for school personnel to be prepared to refer parents to a sleep specialist or sleep clinic.

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## CASE STUDY: A PARENT'S PERSPECTIVE

The first signs of trouble came when our son Josh began to fall asleep in class in the sixth grade. At the time, we chalked it up to a boring teacher. However, as events unfolded later, we probably should have been more concerned.

Although Josh's school had an early start time, he managed fairly successfully until early in the eighth grade when he began to complain about having trouble paying attention in class. An ADHD evaluation indicated attention problems, and Josh was placed on a trial of stimulant medication. However, we discovered no relationship between the stimulant and Josh's ratings of attention, and the medication was discontinued.

By ninth grade, Josh's grades and behavior became more erratic. Josh also began to have significant problems waking up in the morning. Although he tended to stay up late using his computer, when he went to bed at a reasonable hour he complained that he couldn't fall asleep. Our family physician suggested that Josh might be depressed, and we agreed to try an antidepressant medication. Unfortunately, after an encouraging start, the medication failed to help his mood.

Our next move was private school. Maybe Josh's dislike for school was the problem. We found a small boarding school that was more aligned with his interests in computers. In the beginning, Josh liked his teachers, enjoyed his classes, and joined an after-school group of computer networking techies. Although we gave him a clock with an extra-loud alarm, Josh still reported difficulty waking up in the morning, and it dawned on me that his sleep problem might be more than just a recalcitrant teenager challenging authority. By attending sleep workshops and reading, I learned about delayed sleep-phase syndrome, the symptoms of which I recognized immediately: can't fall asleep at night, can't wake up in the morning, tired all day except in the evening. I realized the problem was physiological and not a matter of will power.

I took Josh to a sleep specialist who asked a lot of questions, including questions about Josh's napping pattern. Josh could nap in the mid to late afternoon, but once evening came he could not fall asleep no matter how sleepy he felt. The sleep specialist described this as "the dead zone"—the time of day where the body is physiologically almost incapable of sleeping. Unfortunately, Josh's whole sleep schedule was phase-delayed and his dead zone lasted later into the night than it typically does for adolescents. Whereas the average teenager is ready to sleep at about 11:00 p.m., Josh couldn't fall asleep until 2:00 to 3:00 a.m. When he had to wake up for class at 7:00 a.m., he was in the deepest part of his sleep cycle. With a better understanding of the problem, we thought that we could finally find an effective way to treat the problem. Unfortunately, effective treatment was about as elusive as an accurate diagnosis.

There are a number of treatments for delayed sleep-phase syndrome, and we tried them all. We first tried chronotherapy. In this approach, Josh went to bed two hours later on consecutive nights with the goal of cycling through the 24-hour day until he reached a reasonable bedtime hour. We abandoned this approach after the fourth night when we realized we had effectively shifted his sleep schedule so that he stayed up all night and slept all day! Josh also tried the hormone melatonin, and although it helped him fall asleep more quickly, waking up was still difficult and he felt particularly groggy on days he took melatonin. We tried light therapy for a short time as well. Exposure to very bright lights early in the morning (the same lights used to treat Seasonal Affective Disorder) has been found to gradually shift the sleep phase earlier in the evening. Unfortunately, Josh found it very difficult to tolerate bright lights early in the morning.

After two more challenging years in boarding school (falling asleep in early classes or missing them all together), Josh returned to public school for his senior year. By that time, I knew school would be a disaster without modifications to his schedule. Armed with the sleep specialist's report, I met with the school's Section 504 coordinator. Josh did not need special education status, but I hoped for a delayed start time. I contacted the local community college and was able to patch together a program that had Josh attend high school from 10:00 a.m. to 1:00 p.m. and then take two computer courses at the community college at 5:00 p.m. In between, he worked at a local telecommunications company. The Section 504 coordinator and I had to overcome the resistance of Josh's guidance counselor, who was worried that Josh would accumulate insufficient "seat time" for graduation. In the end, we worked it out and Josh successfully completed his senior year.

The school's willingness to work with us to accommodate Josh's scheduling needs was crucial to his ability to persevere and succeed. Today, Josh is living in his own apartment and has a successful job with a computer security company. Although he still keeps late hours at night, the company he works for is flexible about the time he shows up at the office in the morning.

*Editor's note:* To protect the identity of the people mentioned in this case study, the author wishes to remain anonymous.

## Behavior and Academic Performance

Whether it is the result of a sleep disorder or lifestyle patterns, sleep disruption can have a profound effect on school performance (Dahl, 1999). The most common consequences of insufficient sleep include the following:

- **Sleepiness.** This is most problematic during periods of low stimulation, such as passive or monotonous classroom instruction, reading, driving, or repetitive activities. Excessive sleepiness can cause brief mental lapses, called *micro-sleeps*, which impede concentration and retention and can be

dangerous when driving or operating equipment. Lack of sleep can cause conflicts with parents about getting up for school; lead to an increased use of such stimulants as caffeine or nicotine; and can have a synergistic effect with alcohol, increasing the impairment.

- **Tiredness.** This refers to the psychological effect of excessive sleepiness. Feeling tired makes it difficult for students to initiate and persist at certain types of behavior, especially tasks they view as boring or tedious. The effects are more pronounced for tasks that involve long-term or abstract goals or

consequences (e.g., completing a science fair project or working toward college admission).

- **Emotional changes.** The effect of excessive sleepiness on emotional states is highly variable across individuals and situations. It can include emotional lability, depressive symptoms, increased irritability, impatience, and low tolerance for frustration.
- **Changes in attention and executive functioning.** As indicated earlier, the symptoms associated with excessive sleepiness mimic attention problems such as ADHD, particularly with regard to the ability to perform complex tasks or tasks that require divided attention.

## THE OUTCOMES OF EARLY SCHOOL START TIMES

A study of 17 school districts in the Minneapolis area looked at the effect of school start time on a wide set of variables, including student sleep patterns, academic achievement, student attendance, student behavior, instructional practices, after-school activities, athletics, and transportation. Findings from the study showed that schools with later start times benefited in the following ways:

- Students reported fewer depressive symptoms
- Absenteeism was reduced
- Students reported less difficulty staying awake in class and while taking tests, studying or doing homework, and working on a computer
- Fewer students reported that they fell asleep in class, arrived late to school because they overslept, and felt tired during the day
- Students reported getting significantly more sleep
- Students reported getting higher grades
- Start time did not appear to restrict participation in organized sports or other cocurricular activities
- 57% of teachers reported that a greater number of students were more alert during the first two periods of the day
- 51% of teachers reported that they saw fewer students sleeping at their desks
- The vast majority of staff members reported no negative effect from a later dismissal time
- Students reported going to bed no later as a result of the later start time and got about one additional hour of sleep each night
- In one school district, teachers reported that more students came in early to get extra help
- Teachers reported benefits for themselves, which included being able to prepare for class before school and being more alert and engaged for faculty meetings that were held before school rather than after school
- Teachers were evenly divided on whether they liked or disliked the change in start time, and only 3.5% wanted to return to the previous 7:15 a.m. start time
- 93% of parents indicated that they were pleased with the later start time for their high school-age children.

Source: Wahlstrom, K., Wrobel, G., & Kubow, P. (1998). *Minneapolis Public Schools start time study: Executive summary*. Minneapolis, MN: Center for Applied Research and Educational Improvement. Retrieved September 20, 2004, from <http://education.umn.edu/carei/reports/sst-1998es.pdf>

## School Start Time

Improved understanding of adolescent sleep patterns has led some high schools to delay start times to better match students' sleep needs. Because research suggests that adolescents perform optimally with nine hours of sleep and that the typical adolescent does not feel tired enough to sleep before 11:00 p.m.

(Carskadon, 1999), schools are experimenting with 8:30 a.m. or later start times. One study involving 17 school districts in the Minneapolis area looked at the effect of school start time on a wide set of variables, including student sleep patterns, academic achievement, student attendance, student behavior, instructional practices, after-school activities, athletics, and transportation (Wahlstrom, Wrobel, & Kubow, 1998). Although the study concluded that there were problems associated with making the transition to a later start time, the results after the first year were positive and promising (see "The Outcomes of Early School Start Times").

## The Role of School Administrators

William Dement (1999), the world's leading authority on sleep and sleep disorders, writes, "After all the research I've done on sleep problems over the past four decades, my most significant find-

ing is that ignorance is the worst sleep disorder of them all." School administrators can help address the effect of sleep problems with the following activities:

- Educating staff members, students, and parents about the importance of adequate sleep, the consequences of sleep deprivation, and the symptoms of sleep disorders
- Ensuring that staff members are aware of appropriate accommodations that might be necessary for students with chronic sleep problems
- Identifying appropriate community referral sources for families of students with significant sleep problems
- Integrating topics about sleep and the consequences of sleep deprivation into the health, biology, psychology, and drivers' education curricula
- Examining the feasibility of modifying school schedules (start times) to better conform to adolescent sleep patterns, both for individual students and for the student body as a whole.

The actions and policies of school administrators can have a significant effect on the well-being of sleep-deprived students. Mitigating the effects of sleep problems has implications not only for school performance in the near term but also for students' long-term health and quality of life. Given the pressures of the No Child Left Behind Act (NCLB) and the imperative to improve student outcomes, school administrators clearly need to better understand sleep and the effect of sleep deprivation on mental health and school functioning. **PL**

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Sleep and Adolescents,  
National Association of School Psychologists,  
Peg Dawson, January 2005. [www.nasponline.org](http://www.nasponline.org).



recent study found that "Teens whose parents pack them off to bed at 10 p.m. are less apt to become depressed or have suicidal thoughts than their peers who stay up much later." [8] It should be noted that there is a big difference between having suicidal thoughts and *being* suicidal. In any event, parents can strive to get their teens less wired at night. This can be achieved by discouraging them from drinking caffeine past 12 noon, and by keeping TVs, computers, and especially cell phones out of their room at night.

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Other suggestions include: [5], [2]

1. Encourage a short nap (30 minutes) after school with the alarm clock set.
2. Encourage a regular bedtime routine to help them unwind.
3. Dim the lights as bedtime approaches.
4. Encourage your teen to go to bed and get up at the same time every school day.
5. Cut out late-night phone chats.
6. Avoid arguing with your teen just before bedtime.
7. Pull open the curtains and let the sun shine in, or turn on the bright lights in the morning.
8. Help kids understand that they need more sleep because of changes in their bodies.
9. Let them sleep in on the weekend, but no more than 2 or 3 hours later than their usual time, or it will disrupt their body clock.

Some parents may find it difficult to take these suggestions without imposing more rules on their teens' daily life. Discussing the importance of sleep with teens will make it easier. Since all teens are not the same, parents should use their parenting experience to best help their teens with sleep.

In summary, teenagers are not getting enough sleep on school nights. Sleep deprivation in teens is prevalent enough to cause a growing concern among researchers, educators and parents. Research has shown that lack of sleep affects teens' ability to function at school. Sleep deprivation in teens may have biological causes according to some studies. Teens and their parents should take responsibility for the fact that teens need eight to nine hours of sleep to function at school. Parents can discuss the need for sleep with their teens, and try the suggestions outlined above.

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- [1] [Caffeine-Drinking Teens Don't Get Enough Sleep](#) [Source: ScienceDaily]
- [2] [Wake Up, Sleepy Teens!](#) [Source: parent-teen.com].
- [3] [Why do teenagers sleep late?](#) [Source: BBC News] see [6]
- [4] [Schools Waking Up to Teens' Unique Sleep Needs](#) [Source: The Washington Post]
- [5] [Teen sleep: Why is your teen so tired?](#) [Source: CNN.com from MayClinic.com]
- [6] [Why do teenagers sleep late?](#) [Source: BBC News] see [3]
- [7] [Teens Sleep Longer With Delayed School Starts](#) [Source: US News and World Report]
- [8] [Early Bedtime May Help Stave Off Teen Depression](#) [Source: US News and World Report]

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#### Other Articles:

1. [Adolescent Sleep](#) [Source: Stanford University]
2. [Back-To-School Sleep Routines: A Parent's Guide to Healthy Rest](#) [Source: The Children's Hospital - Denver]
3. [Teens and Sleep](#) [Source: KidsGoals.com]
4. [High School Students With A Delayed School Start Time Sleep Longer, Report Less Daytime Sleepiness](#) [Source: ScienceDaily]

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