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ORIGINAL ARTICLE

Physical, Psychological and Social Effects of Mobile Phone Use in Children: A Prospective Cohort Study

Vineetranjan Gupta*, Arvind Gupta, Shreyansh Valjiyani, Shikha Uppal, Srishti Gautam and Gopal Vishwas

Department of Pediatrics and Neonatology, Asian Institute of Medical Sciences, Faridabad, Delhi NCR, 121001, India

Abstract

The screen whether it is mobile, computer and tablet is a symbol of our modern age. For our children the" digital natives" who have grown up surrounded by digital information and entertainment on screens. Screen Time has become major part of contemporary life. There has been growing concern about the impact of screens on children and young people's health. So, we plan to study the pattern of mobile phone use and reason behind the mobile use along with the various effects of mobile phones amongst the urban children and follow up after 3 months.

Physical inactivity and sedentary behavior have been independently associated with wide range of negative health indicator including obesity, poor cardio metabolic and psycho social health. Total sedentary time can be classified by variety of specific sedentary behavior such as reading, playing quietly, watching television. Mobile phones use which comes under screen time takes almost 1/3rd of total sedentary time. Mobile phone use has become the major part of screen time use. Pediatric organizations recommend no more than 1-2 hour of daily screen time for age 2-5 years and discourage screen time below 2 years of age. Our aim is to systematically examine the pattern of mobile phone use and reason behind the use along with the effect on children in urban population and follow up after 3 months either in person or telephonically.

Abbreviations

WIC: Women Infants and Children; SNS: Social Networking Service; CBT: Cognitive Behavioral Therapy; MI: Motivational Interviewing; MBCT: Mindfulness Based Relapse Prevention; MBRP: Mindfulness Based Relapse Prevention; MORE: Mindfulness Oriented Recovery Enhancement; NAS: Normative Aging Study; RTC: Readiness To Change; IAT: Internet Addiction Test; COVID: Corona Virus Disease; IESB: Internet Enabled Sexual Behavior; CI: Confidence Interval; OD: Odds Ratio; American APA: Psychiatric Association

Introduction

Television, DVDs and other forms of screen media are common pastimes among young children in the United States. Despite the fact that the American Academy of Pediatrics recommends that parents avoid exposing children 2 and under to screen media, a nationally representative

***Corresponding author(s)**

Vineetranjan Gupta, Department of Pediatrics and Neonatology, Asian Institute of Medical Sciences, Faridabad, Delhi NCR, India 121001, India

Tel: +91-814-996-4081
Email: myvineet1689@gmail.com

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survey found that 68% of children under the age of 2 use screen media in a typical day, and that average screen time was 2.05 hours per day [1]. In addition, children may be exposed to more time in front of the television in daycare (an additional hour per day) and home-based childcare settings [2].

Children from lower socio-economic backgrounds may experience disproportionately high rates of screen media time. A study of young children participating in the Women, Infants and Children (WIC) program in New York State found that 82% of one year-old and 95% of two-year-olds watched television and videos on a typical weekday [3]. The average amount of screen time increased with age. One year-old spent an average of 10 hours per week watching TV/videos, while two-year-olds spent approximately 15 hours per week watching TV/videos [3]. Additionally, of the total sample of 2-year-olds in this study, 43% watched more than 2 hours in a typical weekday. Other studies demonstrate that greater television watching in early childhood predicts increased television watching later in childhood [4].

Screen time use may have detrimental effects on children's health and development [5-15]. Studies of young children report associations between screen time and cognitive development outcomes, such as short-term memory skills, academic achievement in reading and math, and language development [5,11,16]. High levels of screen time in early childhood also appear to negatively impact academic and social outcomes in the long-term [9]. Furthermore, while evidence for an association between screen time and BMI among preschool children was inconclusive [17], several studies have reported positive associations later in childhood [3,6,10,18]. Even background television exposure has been shown to impact development by reducing the amount and quality of interactions between parents and children [2,8,19,20]. Beyond the amount of screen time, the content of media exposure is associated with children's developmental outcomes [5,11,21].

Excessive screen time has proven to be an unhealthy habit that begins to develop in early childhood [4]. However, little is known about correlates of screen media use for children under 3. Previous reviews aggregated these correlates with data from children older than, but developmental differences in the infant/toddler years versus later childhood years make it important to examine this youngest age group separately. Infants and toddlers largely depend on their parents for accessing media and alternate activities, in contrast to older children who can more easily express activity preferences and make decisions about their daily activities. Understanding correlates for this age group will help inform clinical and educational practices in the development of early interventions to prevent excessive screen time and potentially the adverse health and developmental outcomes associated with it, particularly among high-risk groups [17,22].

Physical inactivity and sedentary behavior has been independently associated with wide range of negative health indicators including obesity, poor cardio metabolic and psycho social health [23-26]. Sedentary behavior is characterized by waking behavior that requires little energy expenditure. Total sedentary time can be classified by variety of specific sedentary behavior such as reading, playing quietly, watching television. Mobile phones use which comes under screen time takes almost 1/3rd of total sedentary time [27].

Mobile phone use has become a major part of screen time use. Pediatric organizations recommend no more than 1-2 hour of daily screen time for age 2-5 years and discourage screen time below 2 years of age [28,29]. Excessive screen time in young children is associated with aggressive behavior, obesity, may negatively impact attention span, language development and cognitive development. Thus appropriate screen time habits may have important implications for health and wellness throughout life [29]. Several intrapersonal (age) interpersonal (parental mobile use parental rules) and physical environment within the home setting are related to screen time among school going children and youth [30].

In developed countries those in lower socioeconomic level are more likely to be sedentary, while in underdeveloped or developing countries trends is reversed [31-33]. The explosion of new technological devices over the last few years has led to electronic media to become integral part of our life which leads to early exposure of screen in infancy [11,34,35]. Many parents continue their current behavior as they believe that media content is educational [36]. Others causes includes avoiding conflicts, or social isolation or to distract children. Other interpersonal cause is use of screen time by children while mother do their household work or to calm the child while eating out [36-38].

We aimed to systematically evaluate the pattern of mobile phone use and reason behind the use along with the effects on children and also planned to follow up after 3 months of intensive counselling of parents and children either in person or telephonically.

Review of Literature

Global scenario

The Internet is very useful for a variety of purposes, such as convenient electronic commerce, rapid sharing of information, contact with other cultures, emotional support, and entertainment [39,40]. A smartphone combines the services of the Internet and a mobile phone. Smartphones offer qualitatively different services in addition to the benefits that the Internet offers. Young people watch videos, express themselves, communicate with friends, and search for information using smartphones, while older people use their smartphone for having video calls with their children living far away and for playing games. The portability and accessibility of a smartphone make it possible to use it anywhere, for any duration.

Worldwide, smartphones were used by 1.85 billion people in 2014. This number is expected to be 2.32 billion in 2017 and 2.87 billion in 2020 [41]. In 2015, a median of 54 percent across 21 emerging and developing countries such as Malaysia, Brazil, and China reported using the Internet at least occasionally or owning a smartphone. In comparison, a median of 87 percent reported the same across 11 advanced economies, including the United States and Canada, major Western European nations, developed Pacific nations (Australia, Japan, and South Korea), and Israel [42]. In the findings of a survey conducted in 40 nations, South Korea showed the highest rate of smartphone ownership (88%) followed by Australia (77%), and the United States (72%). In a survey on Korean smartphone use in 2016, 83.6 percent of Koreans aged over 3 years were found to use a smartphone. Among them, 86.7 percent of males and 80.6 percent of females reported using a smartphone, and 95.9 percent of teenagers were found to use a smartphone [43]. Indeed, smartphone users are increasing across the world.

Smartphones offer several conveniences in our life, but we also need to be aware of the negative effects of smartphone use, the most concerning aspect being smartphone addiction. Smartphone addiction is a phenomenon that pertains to uncontrollability of smartphone use. People with this problem encounter social, psychological, and health problems [44,45].

Specifically, adolescents are a high-risk group for smartphone addiction. Adolescents are strongly attached to their smartphone, and they regard a smartphone as their second self. Many smartphone users have reported that they would not be able to live without a smartphone [46]. Developmentally, adolescents experience several physical and psychological changes. While, on one hand, they are dependent on their parents with reference to their life and identity, on the other hand, they are trying to be independent of their parents, to establish their identity and to create an independent space for themselves. During these changes, a smartphone becomes indispensable for adolescents. They are interested in new technology and get used to the operation of such devices more easily than adults do. Adolescents, as digital natives, express their thought in an online space, try to keep up with fashion, use many kinds of applications (apps), and search for emotional relationships and support. They are good in multitasking, and they pursue instant reactions and feedback [47]. When these characteristics, including novelty seeking in adolescents, are combined with their immature control competence, they are placed at a high risk of smartphone addiction [48].

Smartphone addiction

Smartphone addiction is considered to be rooted in Internet addiction due to the similarity of the symptoms and negative effects on users. Internet addiction is defined as an impulse control disorder, characterized by pathological Internet use [45,49]. Smartphone addiction could be categorized as a behavioral addiction, such as Internet addiction. Behavioral and chemical addictions have seven core symptoms in common, that is, salience, tolerance, mood modification, conflict, withdrawal, problems, and relapse [50,51]. These common points are not integrally researched, but each symptom has been found in smartphone addiction studies. For instance, Lin Y, et al. reported four features of smartphone addiction, that is, compulsion, functional impairment, tolerance, and withdrawal [52]. Bianchi A, et al. [53] suggested that smartphone overuse associated with psychological symptoms constitutes a form of behavioral addiction. Smartphone addiction is also considered a technological addiction that involves human–machine interaction [54].

Smartphone addiction is considered as the inability to control the smartphone use despite negative effects on users. The use of a smartphone not only produces pleasure and reduces feelings of pain and stress but also leads to failure to control the extent of use despite significant harmful consequences in financial, physical, psychological, and social aspects of life [45,55,56]. Addiction to media has been characterized as excessive or poorly controlled preoccupations, and compulsive needs or behaviors that lead to impairment [57,58]. A study reported that media addicts could not manage real-life activities [45,59]. The people using the Internet longer had poor social support and higher levels of loneliness [60]. Children using the cell phone displayed more behavioral problems such as nervousness, temperament, mental distraction, and indolence, and these problems worsened if the children began using a cell phone at an early age [61].

Awareness regarding the severity of smartphone addiction has already been reflected in clinical science and praxis. The Diagnostic and Statistical Manual of Mental Disorders (DSM-5, American Psychiatric Association (APA), 2013) introduced the diagnostic criteria for Internet gaming disorder and encouraged further research for listing it as a formal diagnosis [62]. Oulasvirta A, et al. [63] reported that the awareness of problems with repeated use of smartphones was underestimated, and only a few reported that they were aware of it. The few respondents reported repeated usage of a smartphone as annoying, addicting, "a trap," and distracting. They were aware that repeated use could lead to addiction; however, they were not aware of the severity of the repeated and intense use of a smartphone. If one is aware of the risks posed by smartphone addiction, one would do something against it. The awareness of the severity of smartphone addiction can, therefore, play a role in preventing it.

Life satisfaction pertains to the normal evaluation of one's surroundings, and subjective happiness or personal contentment [64,65]. Addiction to media could increase depressive symptoms and substance use, and it could decrease well-being [66]. Samaha M, et al. [67] showed that smartphone addiction is not directly linked to life satisfaction, but it is linked via perceived stress and academic performance.

Social problems due to smart phone addiction

Gender, specifically, being male, is a risk factor for pathological Internet use [68]. Results from multivariate logistic regression analyses have suggested 50 percent increased odds for males to be addicted to the Internet (odds ratio (OR) = 1.5, 95% confidence interval (CI) = 1.1, 2.2) as compared with females [69]. Women use the Internet mostly for social purposes and males do so for downloading programs, getting information, and for visiting pornographic sites [70,71]. In contrast to Internet addiction, studies on smartphone addiction reported that females were more dependent on smartphones than males [72]. Females are more likely to be involved with their mobile than males, owing to the differences in the purpose of use of mobile phones. Males are more likely to use their phones for functional purposes, such as work-related use, whereas females primarily use their phones to keep in contact with valued people [73-75]. Thus, it seems that males and females have different smartphone use patterns. Adolescents would be more at risk of smartphone addiction as compared with adults because adolescents are yet to develop self-control in smartphone use. Adolescents with working parents could be at a risk of smartphone addiction, possibly because such children could not be cared by their parents after school, and they would use smartphones without any rules and guidance.

Regarding the income of smartphone users, there were different research results. While one study reported that students from higher income families spent more time and money on their mobile phone, another revealed that lower income students used their mobile phones more often [76,77]. A Pew Research Center survey (2016) reported that people with more education and higher income were more likely to use the Internet or own a smartphone than were those with lower income and less education [42].

Psychological and physical health problem

Smartphone addiction affects physical and psychological health [78]. Depression or anxiety can cause technology addiction, in that individuals with depression or anxiety use smartphone as a coping method to deal with depressive and negative emotions [79]. Smartphone addicts engage in checking behavior and react to notification sounds frequently. That is also a characteristic of depression and anxiety [80,81]. A longitudinal study on heavy users of a computer, social media, and mobile phone showed greater level of prolonged stress, depression, and sleep disturbances [82]. Excessive smartphone use at night could keep one awake till late, thus impairing sleep and influencing stress and depression [83].

Screen time and Internet usage were found to affect sleep, and SNS addicts were reported to show poorer sleep quality than non-SNS addicts [84-86].

The negative effects of smartphone overuse on physical health include cancer; brain tumor; nervous disturbances; weakening of the immune system; problems with the eardrum; pain in the wrist, neck, and joints; fatigue; and sleep disorders [87,88]. As stated above, the overuse of the smartphone causes health problems, but the deprivation of a smartphone can also cause health problems. For instance, smartphone addicts were reported to feel distressed when deprived of their smartphone for some time, and adolescents exhibited anxiety, depression, anger, and sleep disturbances when their smartphones were switched off [89,90].

Addiction treatment

Behavioral treatments: Following the previous studies, personal factors may play a key role in internet use and the development of internet addiction. Adolescent personality traits that correlated positively with internet addiction included high harm-avoidance, reward dependence, low self-esteem, and low cooperation [91]. Poor academic achievement might be associated with low self-esteem and with behavioral problems such as sleep disorders, aggressive or depressive symptoms, dropping out of school, antisocial personality disorder and alcohol abuse [92]. Adolescents with poor academic achievements usually received less respect from surrounding people, and poor academic achievement might be associated with low self-esteem and with behavioral problems such as sleep disorders, aggressive or depressive symptoms, dropping out of school, antisocial personality disorder and alcohol abuse. Those kinds of feelings and isolation would make these adolescents to go online in a search for sense of belonging and self-satisfaction.

Most studies have focused on the relationships between psychological characteristics and internet addiction [93]. Classical treatment had focused on individual factors such as low self-esteem and aggressive and depressive symptoms. The main issue of classic treatment is how to change personal feeling and thoughts.

Cognitive Behavioral Approach (CBT): CBT is the typical mental health care for develop psychological symptoms such as obsessive-compulsive disorder. CBT can assist the individual with internet addiction disorder to recognize thoughts and feelings causing person to inappropriately use the computer to meet personal needs [94]. Generally, CBT is an efficacious method of treating substance abuse, depression and anxiety to substance abuse issues and drug addiction. Further to this, there is evidence to suggest that the use of integrated approaches in dealing with depression and alcohol abuse have a higher rate of success [95,96].

The term of CBT first appeared in scientific literature in the 1970s based on Beck's theory and has since become the treatment of choice for a broad spectrum of behavioral, emotional, and psychiatric problems. To date it has been empirically tested for a range of issues including anxiety disorders, depression, obsessive-compulsive disorders, eating disorders and addiction [97].

CBT is a fusion of 2 distinct traditions in psychology. CBT addresses the interaction of thoughts, emotions, physical sensations, and behaviors. It uses cognitive processing helps clients to recognize negative thoughts and behavioral strategies help them identify helpful and unhelpful behavior.

The role of CBT is to carefully identify the biased cognitive processes that influence behavior and decision making and to shed light on both the process of relapse and the states of mind and reaction that leave a person vulnerable to old solutions. There are 5 stages to change behavior overtime. That is pre-contemplation, contemplation, preparation, maintenance, and termination. In the pre-contemplation stage, therapist focus to break the denial that a serious problem with computer uses exists. In the contemplation stage, individual recognize the need for change, but the desire to change may not be substantial and feeling or being overwhelmed may exist. In the preparation stage, the individual is ready to establish a plan to address the problem. The maintenance sate begins when the individual feels he or she has control over computer use and is putting less energy into the behavioral change. The final stage, termination has the goal to prevent relapse.

CBT is not only about making specific and identified changes to thoughts and behaviors but also making clients their own therapists. This will enable them to apply the learning developed in and between sessions to life in general.

Motivational Interviewing (MI): MI is a brief,

patient-centered, directive approach that emphasized personal choice and responsibility. Generally, MI is the greatest challenges facing substance use disorders treatment agencies. Mostly person who are addicted to something, they deny the problem and do not seek rehabilitate. So for persons who not ready to change their behavior on their own, MI may help [98].

Mindfulness Behavioral Cognitive Treatment (MBCT): Segal Z, et al. [99] found a possible solution in practice of 'mindfulness'- a type of meditation that helps people decenter from negative thoughts and associated sad moods. MBCT appeared to prevent relapse in patients who had experienced three and more episodes of depression. Addiction is in essence a habit. The addicted person is believed to act automatically or 'mindlessly' with little real awareness of the cues and that trigger substance misuse. The idea of promoting mindfulness could thus prove to importance in tackling addictions [97].

Mindfulness-Based Relapse Prevention (MBRP) is another name of MBCT. MBRP is psych educational intervention that combines tradition cognitive-behavioral relapse prevention strategies with meditation training and mindful movement. The primary of goal of MBRP is to help patients tolerate uncomfortable states, like craving and to experience difficult emotions. Mindful movement includes light stretching and other basic gentle movement.

Mindfulness Oriented Recovery Enhancement (MORE) is adapted from MBCT for depression treatment manual. MBRP and MORE is also the program focusing on meditative approaches to coping with cravings, as well as education and training about how to identify and skillfully change or mindfully let be, mental processes like thought suppression, aversion, and attachment [100].

Complementary treatment: Previous studies have documented that an adolescent's family environment is highly predictive for adolescent internet addiction [101]. Moreover, a number of studies in South Korea have found family factors that influence internet addiction among adolescents. There are many researches about the relationships between protective factors such as parenting attitude, communication, and cohesion within families and internet addiction among adolescents [79,101,102].

Complementary treatments have more focused on the environmental factors and use diverse activity for cure the internet addiction. There are many studies for finding the specific effective activities like music, art and even exercise for decreasing the rate of smartphone addition.

Therapeutic recreation: Therapeutic recreation is the professional intervention for leisure life. Therapeutic recreation is the purposeful and careful facilitation of quality leisure experiences and the development of personal and environmental strengths, which lead to greater well-being for people who, due to challenges they may experience in relation to illness, disability, or other life circumstances, need individualized assistance to achieve their goals and dreams [103]. There are many facilitation techniques for gaining the goal.

Few studies have examined the effect that a resource such as leisure activities might have on the relationship between stress and health among elderly men. Data from the Normative Aging Study (NAS) were used to examine whether specific groups of leisure activities (social, solitary, and mixed activities; activities performed either alone or with others) moderated the effect of stress on the health of elderly men and whether there were differences in this effect between bereaved and non-bereaved men. The sample of 799 men was divided into two groups: a group bereaved of family and friends and a group of non-bereaved. Hierarchical regression analyses compared an initial model, a direct effect model, and a moderating model. The results indicate that for both groups of men, mixed leisure activities moderated the effect of stress on physical but not mental health. Additionally, for the bereaved group, social activities moderated the effects of stress on physical health. The negative effects of life stressors (other than bereavement) can be moderated by engaging in leisure activities for both bereaved and non-bereaved elderly men. Implications of the findings for future practice and research are discussed [104].

Family and outdoor activities along with participative and supportive parental monitoring reduce the tendencies. Parental monitoring is inhibitors of adolescents Internet addiction. Thus, adolescent should be supervised and monitored in their daily routines and encouraged to participate in family and outdoor activities. Further, adolescents should develop a positive attitude toward leisure and the skills to deter overdependence on online relationship [105]. Internet addicts can be a form of wrong leisure pattern. Internet addicts often encounter time-management problems. This means

unbalanced time allocation and leisure boredom and unsatisfaction from unpleasant leisure activities may be motivated to seek another alternative of the internet.

The high-risk game addicted people not much leisure activity with families compared to low risk game addicted people. The more they addicted to the game, the more they want to get recreation activities or hobbies. They answered to participating leisure activity with friends (46.4%) or families (27.6%). 65.3% of young juvenile addicted the game want to participate family leisure activity. Unusual thing is students who are rich or have highly educated parents also were addicted to the game [106].

Music therapy: Drumming activities: Recent publications reveal the substance abuse rehabilitation program has incorporated drumming and related community and shamanic activities into substance abuse treatment. Drumming circles have important role as complementary addition therapy, particularly for repeated relapse and when other counseling modalities have failed [107].

Drumming enhances hypnotic susceptibility, increase relaxation, and induces shamanic experiences [108]. Drumming and other rhythmic auditory stimulation impose a driving pattern on the brain, particularly in theta and alpha rages. Physiological changes associated with ASC facilitate healing and psychological relaxation: facilitating self-regulation of physiological processes: reducing tension, anxiety, and phobic reactions: manipulating psychosomatic effects; accessing unconscious information in visual symbolism and analogical representations; including interhemispheric fusion, synchronization and facilitating cognitive-emotional integration and social bonding affiliation [108].

Art therapy: Park KA, et al. [109] applied the art therapy to game addiction juvenile for improving the self-control techniques. As a result, hostile attitude was decreased and social interaction with peer group and family members was increased.

The applicability of exercise rehabilitation

Exercise rehabilitation has the evidence-based exercise science knowledge to address a wide range of physical and psychological problems. It uses exercise programs for patient rehabilitation based on exercise science. It follows the scientific process. In the clinical subfield, baseline such as physical capacity, health information, medical history, work status, previous exercise experience needs to be set. After assessment, supervised rehabilitation sessions conducted for achieving the stated goals. Exercise rehabilitation aims to recover not only musculo-articular rehabilitation after surgery, chronic pain, or fatigue, neurological or metabolic conditions but also even psychological conditions such as depression and anxiety.

Smartphone addiction is psychological disorder appearing physical and psychological signs and symptoms. The person who addicts the internet or smartphone not do much physical activities, they generally disregard their health, and also negative physical signs like carpal tunnel syndrome, poor posture, backaches, migraine headaches, poor personal hygiene, irregular eating, sleep deprivation, eye strain, dry eyes, lack of sleep can affect immune functioning and hormone secretion patterns, cardiovascular and digestive pattern [110].

Exercise rehabilitation can employ the first goal for recuperating their physical health on the surface. Moreover, if they indulge in specific exercise program such as horseback riding or exercise gymnastics, treatment can be going on to the second stage. Mindfulness program is also based on yoga or physical activity for meditation. Exercise rehabilitation could seek mental changes through feeling of confidence, satisfaction, and new feeling of happiness.

Previous studies on the impact of mobile/smart phone use in children

Pearson N, et al. [111] studied the sedentary behavior and dietary intake in children adolescent and adults and reported moderate evidence that television screen time was positively associated with total energy intake and negatively associated with fruits and vegetables consumption in longitudinal studies in both children and adolescents.

Tremblay MS, et al. [112] studied systematic review of sedentary behavior and health indicator in school aged children and youth (5-17) years and stated that positive association is present between television screen time and adiposity, high cholesterol and with low self-esteem.

Sara and Annika, et al. [113] conducted a prospective cohort study on mobile phone use and stress, sleep disturbances and symptom of depression among young adults and has found there were cross sectional

association between high compared to low mobile phone use and stress, sleep disturbance and symptom of depression for men and women in prospective analysis over use was associated with stress and sleep disturbance.

LeBlanc AG, et al. [114] studied the systematic review of sedentary behavior and health indicator in age group 0to4years and stated that infants TV screen time has no benefit and may be harmful in cognitive development. Increased television screen time is associated with increased adiposity. In toddler television screen time has impact on adiposity, cognitive development, affected psychosocial health .In preschoolers television screen time has impact on adiposity and decreased scores on measures of psychosocial health.

Costigan SA, et al. [115] studied the health indicator associated with screen based sedentary behavior among adolescent girls (12 -18) and stated that positive association was present with screen time with weight status, neck shoulder pain, backache, sleep problem, depressive symptoms.

Duch H, et al. [116] studied screen time in less than 3 years of age and stated that positive association is present between Screen time and BMI.

Suchert V, et al. [117] studied sedentary behavior and indicator of mental health in school going children between age 5 to 18 years and stated that positive association present between screen time and hyperactivity/inattention problem, poorer psychological wellbeing and indeterminate association between screen time and depressive and anxiety problem.

Hale L, et al. [118] studied screen time and sleep among school going children and stated that positive association is present with at least one of sleep outcomes (delayed bed time, shortened total sleep time, day time tiredness).

Van Ekris E, et al. [119] studied prospective relationship between childhood sedentary behavior and biomedical health indicator and stated that positive association is present between television screen time and obesity.

Carson, et al. [30] studied sedentary behavior and health indicator in school going children and stated that high Screen time is associated with unfavorable body composition overweight, low esteem lower academic attainment.

Hoare E, et al. [120] studied association between sedentary behavior and mental health in adolescent and stated that positive association is present between Screen time and depressive symptomatology, psychological distress, screen time duration and severity of anxiety symptoms, low esteem.

Wu XY, et al. [121] studied the influence of physical activity sedentary behavior on health related quality of life among children and stated that negative association is present between Screen time and HRQOL (health -related quality of life index) consistent across between higher screen time and lower HRQOL29.

Sharad B, et al. [122] studied the impact of mobile phone among children in rural area of Maharashtra and found that use of mobile phones has increased resulting physical, social and psychological impact.

Rationale of the study

There are considerable studies that includes television use as single most screen time device with considerable evidence of higher level of screen time associated with evidence strongest for adiposity, unhealthy diet, and depressive symptom but now mobile phones have taken considerable amount of screen time among children in recent years. A lot of cross-sectional studies has been done about the effect of mobile phones in children but very few prospective studies has been done about the effects of mobile phones.

After in depth analysis of present literature to the best of our knowledge there is no prospective studies done in urban children between age 1 to 15years of age to assess the pattern of mobile use and reasons behind the mobile phone use along with various effects, effect of counselling about stopping or reducing the use of mobile devices after 3 months.

Aim and Objectives

Aim

To evaluate the impact of mobile phone use in children.

Objectives

- To evaluate the pattern of mobile phone use among children.
- To evaluate the various reasons for the use of mobile phone by children.

- To evaluate the impact of mobile phone use among children.
- To evaluate the impact of 3-months intensive counselling of children and parents on mobile phone use among children.

Material and Methods

Place of study

This proposed study was conducted in the Department of Pediatrics and Neonatology of Asian Institute of Medical Sciences (AIMS), Faridabad, 425 bedded tertiary care institute in Delhi NCR, India.

Study design

This study was a hospital based prospective cohort study.

Study duration

This Study was carried out for a duration of 6 months from October 2020 to March 2021.

Study population

All eligible children between 1 to 15 years of age who visited OPD and IPD of Department of Pediatrics of Asian Institute of Medical Sciences.

Sample size

A total of 500 children were recruited in this study after taking proper informed consent form and based on eligibility criteria.

Inclusion criteria

This study included children of age group between 1 to 15 years who were using mobile/smart phones for any reason.

Exclusion criteria

The children who were mentally challenged, not able to give consent and refused to participate in this study were excluded.

Procedure

After taking written and informed consent from parents, detailed history had taken in pretested questionnaire. Personal information about the child age, gender, along with social economic factors like type of family, father's education, income had been collected from parents in a predesigned questionnaire. Proper counselling of parents and children with explanation regarding adverse effects of use of mobile phone and advise them to stop/reduce it to minimum had given. Socioeconomic status was ascertained by using the Modified Kuppuswamy scale (Annexure 4). Follow up interview was done either in person or telephonically after 3 months to see reduction / disappearance of adverse effects, noted earlier.

Sample size calculation

The study of Sharad Bansal, et al observed that out of total children attending the department of Pediatrics OPD, 36 (8.0%) children have never used mobiles. Taking this value as reference, the minimum required sample size with 2.5% margin of error and 5% level of significance was 453 patients. To reduce margin of error, total sample size of 500 had been taken.

Formula used is:

$N \geq p\,(1-p)/(ME/Z\alpha)2$

where $Z\alpha$ is value of Z at two-sided alpha error of 5%,

ME is margin of error.

p is proportion of patients using mobile phones.

Calculations: -

$n \geq ((.08^{*}(1- .08)) / (.025/1.96)2 = 452.39 = 453$(approx).

Statistical analysis

The data were entered in Microsoft excel (v2016) and analysis was done using Statistical Package for Social Sciences (SPSS) version 25.0. Categorical variables were represented as Frequency and percentage (%) and continuous variables were represented as mean ± SD and median. Chi Square test/Fisher's Exact test was used to compare qualitative variables. A *p* value of < 0.05 considered as statistically significant.

Results

The proposed hospital based single centered prospective cohort study was conducted in the department of Pediatrics, Asian Institute of Medical Sciences, Faridabad. This study was conducted for a duration of 6 months from October 2020 to March 2021. A total of 500 children were enrolled in this study of age group of 1-15 years visited in OPD and IPD of Department of Pediatrics of Asian Institute of Medical Sciences.

Socio-demographic characteristics of participants

Table 1 shows that 377 (75.40%) participants were male and 123 (24.60%) were female child. While the children were below 3 years 28 (5.60%), 3-6 years 84 (16.80 %), between 7-9 years were 211 (42.20 %), between 10-12 were 113 (22.60 %) and 64 (12.80%) belonged to 13-15 years of age group.

There were 331(66%) participants were from urban type of residence and 33% participants belonged to rural area of residence. Majority 315 (63%) of the children belonged to nuclear family, 33 (6.6%) children belonged to extended family and 152 (30.4%) children belonged to joint family. More than 99% fathers were educated and 88% of mothers were educated. In the present study 12 (2.40%) children were from lower class of socioeconomic status, 68(13.60%) belonged to upper class but majority of participants 207(41.40%) belonged to lower middle and 172 (34.40%) participants belonged to upper middle class of socioeconomic status.

Table 1: Distribution of children according to the socio-demographic factors.

Characteristics (Subgroups)		Frequency	N%
Child's age (In year)	<3	28	5.60%
	3-6	84	16.80%
	7-9	211	42.20%
	10-12	113	22.60%
	13-15	64	12.80%
Sex	Female	123	24.60%
	Male	377	75.40%
Type of Residence	Rural	169	33.80%
	Urban	331	66.20%
Type of Family	Joint	152	30.40%
	Extended	33	6.60%
	Nuclear	315	63.00%
Education of Mother	Illiterate	111	22.20%
	Primary	49	9.80%
	High school	52	10.40%
	Secondary	52	10.40%
	Graduation	175	35.00%
	Post-graduation	57	11.40%
	Professional	4	0.80%
Education of Father	Illiterate	8	1.60%
	Primary	26	5.20%
	High school	98	19.60%
	Secondary	35	7.00%
	Graduation	137	27.40%
	Post-graduation	142	28.40%
	Professional	54	10.80%
Socioeconomic Status	Upper	68	13.60%
	Upper middle	172	34.40%
	Upper lower	41	8.20%
	Lower middle	207	41.40%
	Lower	12	2.40%

Distribution of parents according to the mobile use

It was seen from table 2 that 359 (71.80%) mothers of children had mobile phone. But 500 (100%) fathers of children had mobile phone. 454 (90.80%) parents used smart phone device. While 449 (89.90%) parents have internet access on their mobiles. 241 (48.20%) parents used mobile for 1-3 hours and 78 (15.60%) parents were using mobiles for more than 3 hours per day.

Figure 1 shows children were below 3 years 28 (5.60%), 3-6 years 84 (16.80 %), between 7-9 years were 211 (42.20 %), between 10-12 were 113 (22.60 %) and 64 (12.80%) belonged to 13-15 years of age group.

Figure 2 shows children were below 3 years 28 (5.60%), 3-6 years 84 (16.80 %), between 7-9 years were 211 (42.20 %), between 10-12 were 113 (22.60 %) and 64 (12.80%) belonged to 13-15 years of age group.

Figure 3 there were 331(66%) participants were from urban type of residence and 33% participants belonged to rural area of residence.

Figure 4 shows in the present study 111 (22.20%) mother and 8 (1.60%) fathers were illiterate. There were 49 (9.80%) mother and 26 (5.20%) fathers were having primary education. There were 52 (10.40%) mother and 98 (19.60%) fathers were having High

Table 2: Distribution of parents according to the mobile use.

Characteristics (Subgroups)		Frequency	N%
Do mother have mobile phone?	No	141	28.20%
	Yes	359	71.80%
Do father have mobile phone?	Yes	500	100.00%
Do parents have smart phone?	No	46	9.20%
	Yes	454	90.80%
Do parents have internet access on mobile phone?	No	51	10.20%
	Yes	449	89.80%
For how many hours a day do parents use mobile phones?	<1 hour	181	36.20%
	1-3 hours	241	48.20%
	>3 hours	78	15.60%

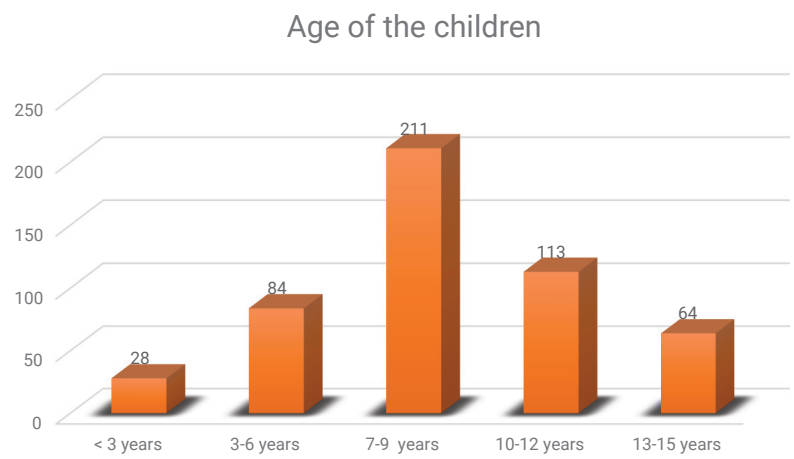

Figure 1 Age distribution among children.

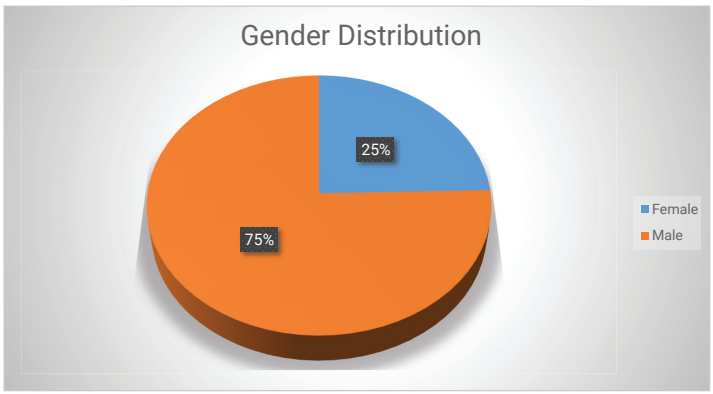

Figure 2 Gender distribution.

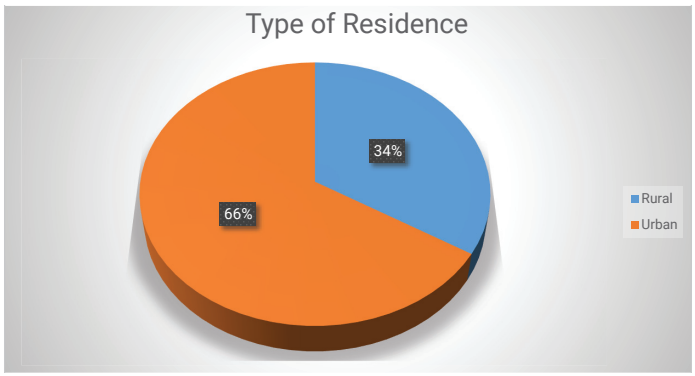

Figure 3 Type of residence.

school education. There were 52 (10.40%) mother and 35 (7.00%) fathers were having secondary education. There were 175 (35.00%) mother and 137 (27.40%) fathers were having graduation in education. There were 57 (11.40%) mothers and 142 (28.40%) fathers were having post-graduation in education. There were 4 (0.80%) mother and 54 (10.80%) fathers were having Professional in education.

Figure 5 in the present study 12 (2.40%) children were from lower class of socioeconomic status, 68(13.60%) belonged to upper class but majority of

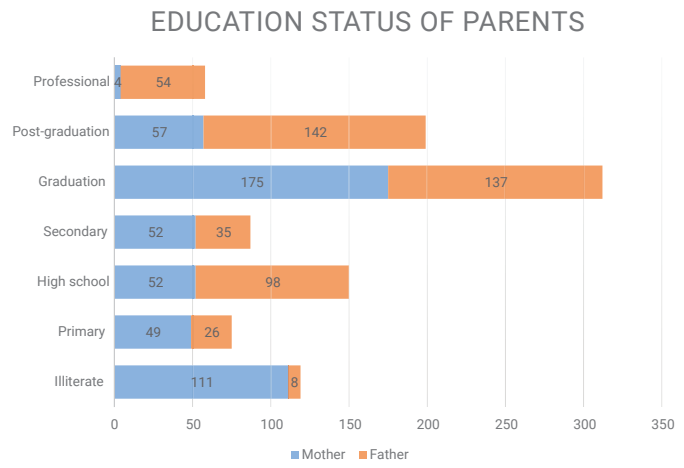

Figure 4 Education status of parents.

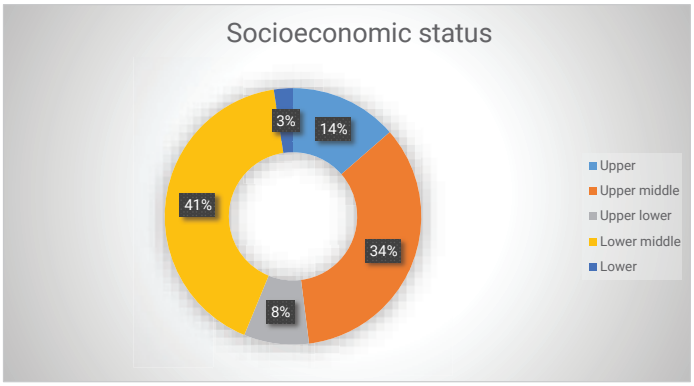

Figure 5 Education status of parents.

participants 207(41.40%) belonged to lower middle and 172 (34.40%) participants belonged to upper middle class of socioeconomic status.

Distribution of children according to the mobile use

Table 3 shows that 500 (100%) children were using their parents. There were 265 children (53%) used their mother mobile phone and 235 children (47%) used their father mobile phone. Majority of children 302 (60.40%) were using mobiles for 1-3 hours followed by 119 (23.80%) children those who used mobile for less than 1 hours. Majority 158 (31.60%) of the children were using mobile for watching U-tube videos/app-based series, followed by 125 (25%) for playing games and 112 (22.4%) children were surfing internet. Following were the reasons to give mobile to children, majority 177 (35%) cases mobile was to quiteten down the children, 158(35%) had other reason like (child tantrums for mobile, child does not listen, to make show off in society etc.) and 93 (19%) believed that mobile phone would be helpful for their academics.

Impact of mobile phone on children

Mobile phones had serious impact on children. The children who used mobile phones had physical, psychological, and social morbidities. The various morbities observed in the present study as shown in table 4.

Physical effect: Physical morbidities like headache in 426 (85%), pain in shoulder in 472 (94%), neck pain in 484(96%), wrist pain/pain in finger in 454 (91%), Frequent blinking of eyes in 425(85%) and watering from eyes in 419(84%) children were reported.

Psychological effect: Psychological morbidities like restlessness/ hyperactivity in 378 (76%), laziness in 421 (84%), inability to sit at one place in 389 (78%),

Table 3: Distribution of children according to the mobile use.

Characteristics (Subgroups)		Frequency	N%
Does child use mobile phone?	Yes	500	100.00%
Whose mobile does the child use?	Father	235	47.00%
	Mother	265	53.00%
For how many hours does the child use mobile phone?	<1 hour	119	23.80%
	1-3 hours	302	60.40%
	>3 hours	79	15.80%
What does he/she use mobile phone for?	Internet surfing	112	22.40%
	Listening to music	28	5.60%
	Others	77	15.40%
	Playing games	125	25.00%
	Watching YouTube/app-based series	158	31.60%
Why is mobile phone being given to child?	Any other reason	177	35.40%
	It is helpful for him/her in academics	93	18.60%
	To quieten him/her down	177	35.40%
	While feeding	53	10.60%

Table 4: Distribution of children according to the effects of mobile use.

Characteristics (subgroups)	Frequency	N%
Physical Effects		
Headache	426	85.20%
Pain in shoulder	472	94.40%
Neck pain	484	96.80%
Wrist pain/pain in fingers	454	90.80%
Frequent blinking of eyes	425	85.00%
Watering from eyes	419	83.80%
Psychological Effects		
Restlessness/hyperactivity	378	75.60%
Laziness	421	84.20%
Inability to sit in one place	389	77.80%
Irritability/Tantrums	398	79.60%
Depression	436	87.20%
Anxious	447	89.40%
Social Effects		
Delayed speech	456	91.20%
Abnormal behaviour	420	84.00%
Delayed response to verbal commands	446	89.20%
Features of Autism Spectrum Disorder	461	92.20%
Poor scholastic performance or drop in scholastic performance	458	91.60%
Antisocial behaviour (for e.g. does not want to mingle with family, relatives, and friends)	472	94.40%

irritability/tantrums in 398 (80%), depression in 436 (87%) and anxious in 447 (89%) children were reported.

Social effects: Social morbidities like delayed speech in 456 (91%), abnormal behavior in 420 (84%), delayed response to verbal command in 446 (89%), features of autism spectrum disorder in 461(92%), poor scholastic performance in 458 (92%) and anti-social behavior in 472 (94 %) children were reported.

Figure 6 in this study shows Physical morbidities like headache in 426 (85%), pain in shoulder in 472 (94%), neck pain in 484(96%), wrist pain/pain in finger in 454 (91%), Frequent blinking of eyes in 425(85%) and watering from eyes in 419(84%) children were reported.

Figure 7 psychological morbidities like restlessness/ hyperactivity in 378 (76%), laziness in 421 (84%), inability to sit at one place in 389 (78%), irritability/tantrums in 398 (80%), depression in 436 (87%) and anxious in 447 (89%) children were reported.

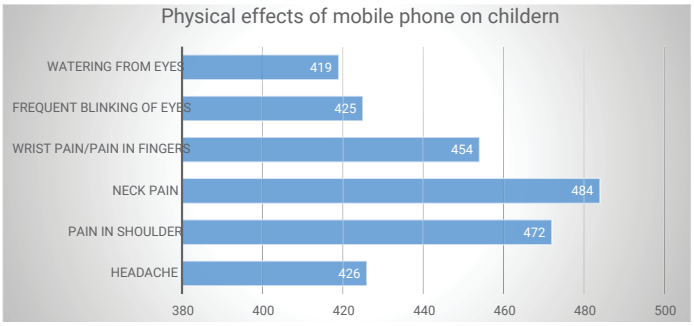

Figure 6 Physical effects of mobile phone.

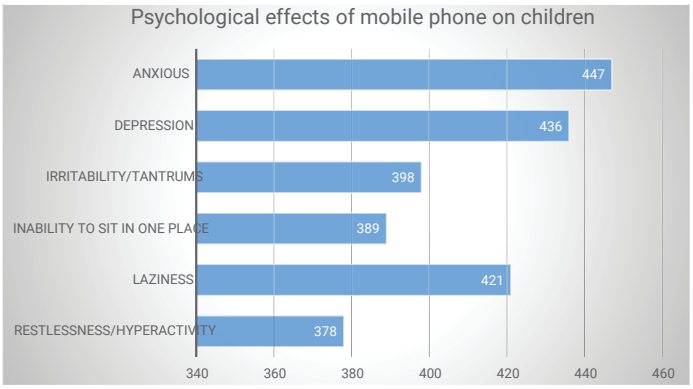

Figure 7 Psychological effects of mobile phone on children.

Figure 8 social morbidities like delayed speech in 456 (91%), abnormal behavior in 420 (84%), delayed response to verbal command in 446 (89 %), features of autism spectrum disorder in 461(92 %), poor scholastic performance in 458 (92%) and anti-social behavior in 472 (94 %) children were reported.

Impact of 3 months intensive counselling of parents and children on adverse effects of mobile phone use

In our, initially adverse effects of mobile phone of 500 children were recorded before counselling. But only 360 participants had completed the three months of intensive counselling. Remaining 140 participants were excluded from analysis due to various reason like loss to follow up (120), withdrawn consent (5), and missing data (15).

Impact of intensive counselling on physical effects: After 3-month intensive counselling; the physical effects like headache (85% *vs.* 66%; $p < 0.001$), pain in shoulder (94% *vs.* 79%; $p < 0.001$), Neck pain (95% *vs.* 86%; $p < 0.001$) wrist pain/pain in fingers (90% *vs.* 81%; $p = 0.001$) and watering from eyes (85% *vs.* 78%, $p = 0.03$) were significantly improved among children (Table 5).

Impact of intensive counselling on psychological effects: After 3-month intensive counselling; the psychological effects like restlessness/hyperactivity (76% *vs.* 65%; $p = 0.002$), irritability (80% *v.s* 69%, $p = 0.002$) were significantly improved among children (Table 5).

Impact of intensive counselling on social effects: After 3-month intensive counselling; social effects like delayed speech (91% *vs.* 86%, $p = 0.04$), abnormal behavior (83% *vs.* 77%; $p = 0.02$), delayed response to verbal command (90% *vs.* 63%, $p < 0.001$), features of autism spectrum disorder (93% *vs.* 83%, $p < 0.001$), poor scholastic performance (91% *vs.* 77%, $p < 0.001$) and anti-social behavior (94% *vs.* 74%, $p < 0.001$) were significantly improved among children (Table 5).

Figure 9 shows after 3-month intensive counselling; the physical effects like headache (85% *vs.* 66%; $p < 0.001$), pain in shoulder (94% *vs.* 79%; $p < 0.001$), Neck pain (95% *vs.* 86%; $p < 0.001$) wrist pain/pain in fingers (90% *vs.* 81%; $p = 0.001$) and watering from eyes (85% *vs.* 78%, $p = 0.03$) were significantly improved among children.

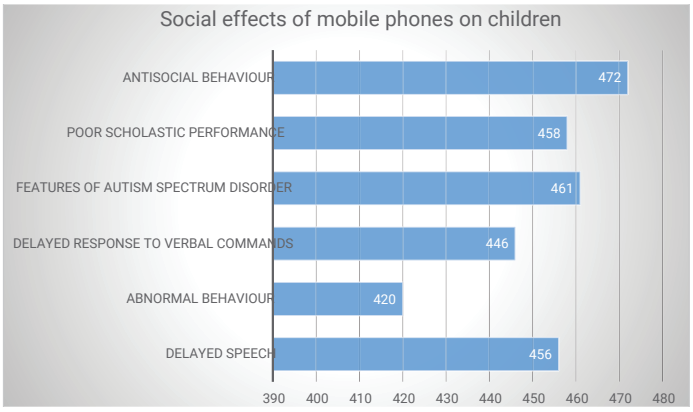

Figure 8 Social effects of mobile phones on children.

Table 5: Impact of 3-month intensive counseling of parents and children (n = 360).

Characteristics (Subgroups)	Counselling		p
	Before	After	
Physical effects			
Headache	309(85.8)	241(66.9)	< 0.001
Pain in shoulder	340(94.4)	287(79.7)	< 0.001
Neck pain	345(95.8)	312(86.7)	< 0.001
Wrist pain/pain in fingers	325(90.3)	295(81.9)	0.001
Frequent blinking of eyes	301(83.6)	312(86.7)	0.249
Watering from eyes	305(84.7)	284(78.9)	0.03
Psychological Effects			
Restlessness/hyperactivity	274(76.1)	236(65.6)	0.002
Laziness	301(83.6)	309(85.8)	0.407
Inability to sit in one place	291(80.8)	279(77.5)	0.7
Irritability/Tantrums	288(80)	247(68.6)	0.02
Depression	314(87.2)	311(86.4)	0.74
Anxious	319(88.6)	308(85.6)	0.22
Social Effects			
Delayed speech	327(90.8)	309(85.8)	0.04
Abnormal behaviour	300(83.3)	276(76.7)	0.02
Delayed response to verbal commands	323(89.7)	227(63.1)	< 0.001
Features of Autism Spectrum Disorder	334(92.8)	297(82.5)	< 0.001
Poor scholastic performance or drop in scholastic performance	330(91.7)	279(77.5)	< 0.001
Antisocial behaviour	338(93.9)	261(72.5)	< 0.001

*Pearson's Chi-square test.

Figure 10 after 3-month intensive counselling; the psychological effects like restlessness/hyperactivity (76% *vs.* 65%; p = 0.002), irritability (80% *vs.* 69%, p = 0.002) were significantly improved among children.

Figure 11 shows after 3-month intensive counselling; social effects like delayed speech (91% *vs.* 86%, p = 0.04), abnormal behavior (83% *vs.* 77%; p = 0.02), delayed response to verbal command (90% *vs.* 63%, p < 0.001), features of autism spectrum disorder (93% *vs.* 83%, p < 0.001), poor scholastic performance (91% *vs.* 77%, p < 0.001) and anti-social behavior (94% *vs.* 74%, p < 0.001) were significantly improved among children.

Discussion

Sociodemographic characteristics of participants

In the present study, 377 (75.40%) participants were male and 123 (24.60%) were female child. While the children were below 3 years 28 (5.60%), 3-6 years 84 (16.80 %), between 7-9 years were 211 (42.20 %), between 10-12 were 113 (22.60 %) and 64 (12.80%) belonged to 13-15 years of age group. There were 331(66%) participants were from urban type of residence and 33% participants belonged to rural area of residence. Majority 315 (63%) of the children

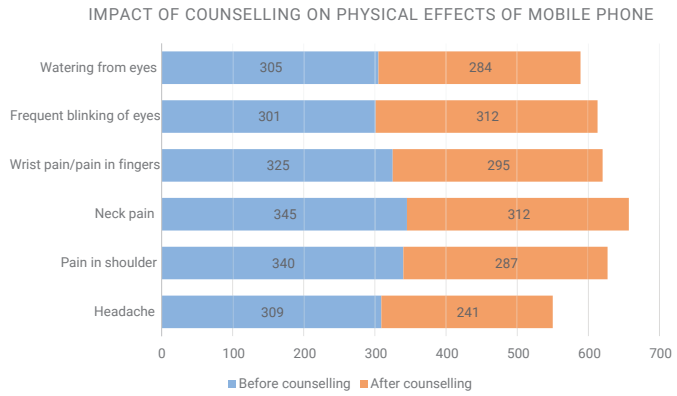

Figure 9 Impact of intensive counselling on physical effects.

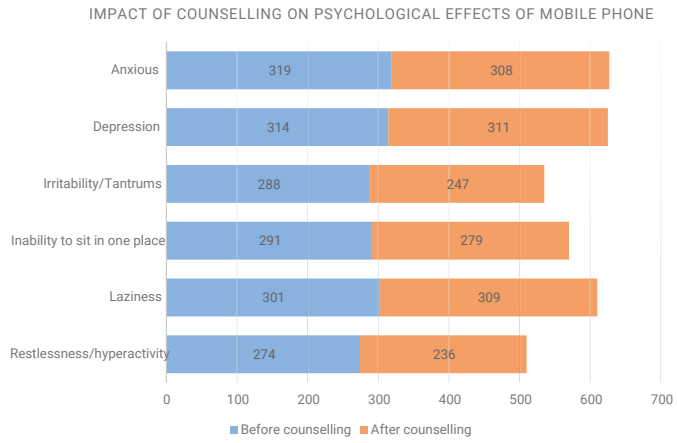

Figure 10 Impact of intensive counselling on psychological effects.

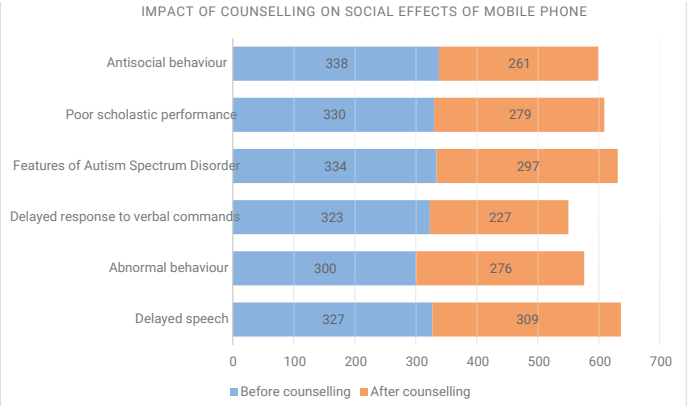

Figure 11 Impact of intensive counselling on social effects.

belonged to nuclear family, 33 (6.6%) children belonged to extended family and 152 (30.4%) children belonged to joint family. More than 99% fathers were educated and 88% of mothers were educated. In the present study 12 (2.40%) children were from lower class of socioeconomic status, 68(13.60%) belonged to upper class but majority of participants 207(41.40%) belonged to lower middle and 172 (34.40%) participants belonged to upper middle class of socioeconomic status. In study conducted by Bansal S, et al. 277 (61.5%) participants were male and 173 (38.5%) were girl child. While the children were 3-6 years 79 (17.5%), between 7-9 years were 201 (44.7%), between 10-12 were 108 (24.0%) and

62 (13.8%) belonged to 13-15 age group. Majority 121 (26.88%) of the children belonged to joint family and 121 (26.88%) children belonged to nuclear family. More than 87% fathers were educated and 85% of mothers were educated. There were 122 (27.1%) children were from class- V of socioeconomic class, 175 (38.8%) class- V and 13 (2.8%) class- I [122]. These finding are like study by Carson V, et al. [30] they found that over half (53.5%) of the children were male and the average age was 41 months or 3 years. For screen time, 13.6% engaged in > 2 hour/day and 43.5% engaged in > 1 hour/day.

Distribution of parents according to the mobile use

In this current study, 359 (71.80%) mothers of children had mobile phone. But 500 (100%) fathers of children had mobile phone. 454 (90.80%) parents used smart phone device. While 449 (89.90%) parents have internet access on their mobiles. 241 (48.20%) parents used mobile for 1-3 hours and 78 (15.60%) parents were using mobiles for more than 3 hours per day.

Bansal S, et al. [122] in their study showed that 414 (92.1%) parents used mobile phones and 350 (77.8%) parents had smart phones. While 325 (72.2%) parents have internet access on their mobiles. 323 (71.7%) parents used mobile for 1-3 hours and 61 (13.5%) parents were using mobiles for more than 4 hours per day.

Distribution of children according to the mobile use

In our study, 500 (100%) children were using their parents. There were 265 children (53%) used their mother mobile phone and 235 children (47%) used their father mobile phone. Majority of children 302 (60.40%) were using mobiles for 1-3 hours followed by 119 (23.80%) children those who used mobile for less than 1 hours. Majority 158 (31.60%) of the children were using mobile for watching U-tube videos/app-based series, followed by 125 (25%) for playing games and 112 (22.4%) children were surfing internet. Following were the reasons to give mobile to children, majority 177 (35%) cases mobile was to quiteten down the children, 158(35%) had other reason like (child tantrums for mobile, child does not listen, to make show off in society etc.) and 93 (19%) believed that mobile phone would be helpful for their academics.

In the study conducted by Bansal S, et al. [122] 433 (96.3%) children were using their parents or relatives' mobiles and only 36 (8.0%) children have never used mobiles. Majority 194 (43.1%) of the children were using mobiles for 1-3 hours followed by 130 (28.8%) children those who used mobile for more than 4 hours. Majority 176 (42.5%) of the children were using mobile for playing games, followed by 145 (35.0%) watching U-tube videos and 104 (25.1%) children were surfing internet. Following were the reasons to give mobile to children, majority 207 (50.0%) cases mobile was given to tackle with the tantrums of not giving mobile, 154 (37.1%) cases to keep child engaged and in 133 (32.1%) children, that does not to parents not to use mobile.

Similarly, a study by Muduli JR. [123] found that nearly 68% of the total respondents are spending more than 6 hours per day with their technological devices and enjoy the services out of them.8 Where 20% participants are using the gadgets for 4-6 hours per day and 7% of them are using these for 2-4 hours. The number of participants those spend 1-2 hours per day with their gadgets was very less i.e., only 19.5%.

In study by Subrahmanyam K, et al. [124] observed that, although playing specific computer games has immediate positive effects on specific spatial, iconic, and attentional skills used by the game. In a survey they found that people with gadget addiction display several troubling symptoms, such as the fear of missing something important when offline; a detachment from close people and favorite activities in favor of gadgets; headaches, poor vision, social anxiety [125]. In the study by Cerutti R, et al. [126] results highlighted the potential impact of excessive internet and mobile use, which ranges from different types of headaches to other somatic symptoms.

Impact of mobile phone on children

In our study, physical morbidities like headache in 426 (85%), pain in shoulder in 472 (94%), neck pain in 484(96%), wrist pain/pain in finger in 454 (91%), Frequent blinking of eyes in 425(85%) and watering from eyes in 419(84%) children were reported. Psychological morbidities like restlessness/ hyperactivity in 378 (76%), laziness in 421 (84%), inability to sit at one place in 389 (78%), irritability/ tantrums in 398 (80%), depression in 436 (87%) and anxious in 447 (89%) children were reported. Social morbidities like delayed speech in 456 (91%), abnormal behavior in 420 (84%), delayed response

to verbal command in 446 (89 %), features of autism spectrum disorder in 461(92 %), poor scholastic performance in 458 (92%) and anti-social behavior in 472 (94 %) children were also reported.

Bansal S, et al. [122] showed that various physical morbities like decreased physical activity in 189 (45.8%) children, laziness in 143 (34.7%) children, pain in fingers and wrist in 76 (18.5%) and eyes symptoms in 148 (35.7%) children were observed. While mental issues faced were, throwing tantrums if mobile not given in 187 (45.3%) children, anxious child while playing games 182 (44.1%), reduction in sleep 134 (32.5%) and increased irritability in 120 (29.1%) students. Following social problems were noted, not obeying parents 110 (26.6%), reduced grades in school 89 (21.4%), 45 (11.0%) not mixing in friends and 16 (0.4%) children were caught watching porn.

Similar findings were noted by Hale L in their study of the 12 looking at TST or delayed bedtime, 10 (83%) found a statistically significant association between either shortened TST or delayed bedtime.4 Of the studies that estimated the amount to which sleep duration was shortened [118].

In a study by Muduli JR [123] observed that the overuse of the technological devices by the respondents has a greater effect on the anxiety and stress level of them.8 there is direct relation between the use of gadgets and the level of anxiety and stress. It shows that the degree of the anxiety or nervousness is normal in case of the low users of the devices, and it increase with the increase of time period of use from mild to severe.

Similarly, in a study by Saruji MA, et al. [127] in their study found that Technology enriches basic skills and physical activity, keeping track of children using the GPS trackers within the phone.12 On the contrary, loss of privacy, lessened ability to multitask, health-related issues like obesity and children's sensory skill development and changing social norms like children feel lonely and depressed.

Agarwal V, et al. [128] in a survey among adolescents, it was found that among school going adolescents, the incidence of technology addiction (internet and mobile addiction) was moderate, and females were at lower risk to develop technology addictions like internet addiction.

Kim R, et al. [129] conducted a research to examine the relationships among mobile phone use, anxiety, and parental attitudes toward child-rearing in a convenience sample of 351 grade 6 elementary school students.14 Mobile phone use was greater in girls than in boys, and the difference was statistically significant. Mobile phone use was positively correlated with anxiety, and it was negatively correlated with parental child-raising attitudes.

Similarly, Lee JE, et al. [130] studied a total of 1,125 students at baseline were included in this study after excluding those who already had poor sleep quality or short sleep duration in the previous year.15 A generalized estimating equation was used to analyze the data. High mobile phone addiction (mobile phone addiction score >20) increased the risk of poor sleep quality but not short sleep duration.

A systematic review conducted by Sahu M, et al. [131] showed that the prevalence of problematic mobile phone use was found to be 6.3% in the overall population (6.1% among boys and 6.5% among girls). The review finds that excessive or overuse of mobile phone was associated with feeling insecurity; staying up late at night; impaired parent–child relationship; impaired school relationships; psychological problems such as behavioral addiction like compulsive buying and pathological gambling, low mood, tension and anxiety, leisure boredom, and behavioral problems, among which most pronounced association was observed for hyperactivity followed by conduct problems and emotional symptoms.

Impact of 3 months intensive counselling of parents and children on adverse effects of mobile phone use

In this present study, after 3-month intensive counselling; the physical effects like headache (85% *vs.* 66%; $p < 0.001$), pain in shoulder (94% *vs.* 79%; $p < 0.001$), Neck pain (95% *vs.* 86%; $p < 0.001$) wrist pain/ pain in fingers (90% *vs.* 81%; $p = 0.001$) and watering from eyes (85% *vs.* 78%, $p = 0.03$) were significantly improved among children. the psychological effects like restlessness/hyperactivity (76% *vs.* 65%; $p = 0.002$), irritability (80% *vs.* 69%, $p = 0.002$) were significantly improved among children. social effects like delayed speech (91% *vs* 86%, $p = 0.04$), abnormal behavior (83% *vs.* 77%; $p = 0.02$), delayed response to verbal command (90% *vs.* 63%, $p < 0.001$), features of autism spectrum disorder (93% *vs.* 83%, $p < 0.001$), poor scholastic performance (91% *vs.* 77%, $p < 0.001$) and anti-social behavior (94% *vs.* 74%, $p < 0.001$) were significantly improved among children.

This is in line with the research findings of Kolubinski DC, et al. [132] that the CBT approach has a large effect in solving problems related to increasing low self-esteem in students, reducing the presence of depressive symptoms and in someone who has a learning disability that is good through the provision of cognitive-behavioral training. Furthermore, Shaarbaf AHR, et al. [133] also explain that cognitive-behavioral counseling improving self-esteem in adolescence. Besides, Young KS [134] found that counseling with cognitive-behavioral approaches or CBT effects of exploration on the mind in reducing the use of smartphones that cause addiction in students. Equally, Kim H [106] concludes that the cognitive-behavioral approach also helps to overcome cognitive, social, and behavioral problems in compulsivity which results in adolescent mobile phone addiction.

It is seen that cognitive-behavioral counseling affects students who experience problematic self-esteem which impacts the use of mobile phone addiction. Like previous studies where You Z, et al. recommends more intervention in cognitive-behavioral counseling to give effect to students who experience mobile phone addiction in students due to social and personal problems, one of which is self-esteem. Based on previous research recommendations, where this research proves the effect of cognitive-behavioral counseling on self-esteem and mobile phone addiction [135].

With cognitive-behavioral counseling has a positive effect on overcoming cell phone abuse and developing skills in healthy internet use [136]. It also refers to the purpose of a cognitive-behavioral approach that works based on my behavior and emotions that an individual has which is more about the perception of what he already knows. Thus, this condition will provide learning for students in responding to existing situations and be able to think positively and be responsible for changing the way of thinking that causes cognitive distortion and addiction behavior that inhibits self-esteem in students and the use of mobile phones that are more appropriate with the aim of benefiting in his life. Based on the findings of this study, the cognitive-behavioral counseling implications have a high efficacy on self-esteem and the tendency of mobile phone addiction separately. Also, the effect on the identification of self-esteem on the tendency of mobile phone addiction is applied by cognitive-behavioral counseling in individual services.

Besides, what needs to be addressed by the counselor in the implementation of cognitive-behavioral counseling towards self-esteem and mobile phone addiction is the time when sufficient availability will have a better effect as a cognitive modification process of the counselee's behavior in service delivery. This will affect self-esteem and the tendency of mobile phones for students in the counseling process [137].

In a previous study conducted by Orzack MH, et al. [138] to evaluate the effectiveness of using group therapy treatment, Readiness to Change (RtC), Cognitive Behavioral Therapy (CBT), and Motivational Interviewing (MI) interventions and to examine the impact of comorbidity on the outcomes of the treatment among 35 males suffered from problematic Internet-Enabled Sexual Behavior (IESB) for 16 weeks. The addicts were classified into three groups: anxiety, attention deficit hyperactivity, and mood. The findings showed significant improvements in clients' quality of life and scores of depression symptoms; however, no significant improvement was reported in Internet use. Concerning comorbidity, the anxiety group reported the best response to treatment, while mood group response was positively relative and attention deficit hyperactivity showed no response.

In another study, Du YS, et al. [139] studied the effect of a cognitive behavioral group therapy in treatment of Internet addiction. Two groups were selected randomly, in which the first group consisted of 32 clients aged between 12 and 17 years who had the school-based group CBT and the second group consisted of 24 clients who did not expose to any intervention. The clients were evaluated three times: pretreatment, immediately after treatment of eight sessions, and in the sixth month. The results showed the treatment group had improvements in time management skills, emotional, cognitive, and behavioral symptoms.

In a study, Young KS, [140], evaluated the effectiveness of the model of CBT-IA in treatment of Internet addiction. A total of 128 addicts were recruited, the Internet Addiction Test (IAT) was used to assess and classify them, and then, they received twelve sessions of CBT-IA/week. The effect of treatment was evaluated at the end the 12 weeks, 1 month, 12 months and at 6-month posttreatment. The findings found that more than 95% of the clients had ability to manage the problem at the end of the 12 weeks, and 78% maintained recovery 6 months after

treatment. In a recent pilot study conducted by Lan Y, et al. [141] showed that group mindfulness-based cognitive-behavioral intervention could significantly alleviate smartphone addiction among university students. According to latest studies, it is come to know that there are two schools of thoughts. Some researchers believe that there is a positive association between cell phone addiction and the mental health of adolescence and some believe that there is a negative or indirect relation in them [142]. Another study, conducted by Li T, et al. [143] showed that the eight-week CBT designed in this study can reduce the college students' mobile phone dependence, obsessive-compulsive symptoms and interpersonal sensitivity [144]. Another study, conducted by Kumar VA, et al. [145] showed that there is prevalence of smartphone addiction among medical college students was 52%. Smartphone addiction was seen more in boys than girls. There was a significant association between the smartphone addiction and sleep disturbance. However, there was no significant association between smartphone addiction and low self-esteem.145 Another Study, conducted by Verma N, et al. [146] showed there is prevalence of smartphone addiction in medical students was 34.8%. Smartphone addiction was associated with higher perceived stress and loneliness. Students having Smartphone addiction scored lower on personality domains of extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience. Moreover, Smartphone addiction interfered with students' social life and academic performance. Our study also showed significant improvement in physical, psychological and social effects by intensive 3 months counselling.

Limitation of study

There were few limitations of our study like small sample size, single centered, more withdrawal and loss to follow up for intensive counselling due to COVID pandemics. So, in future, there will be large prospective population-based study is required to evaluate the adverse impact of mobile phone abuse and impact of cognitive behavior therapy on mobile phone addiction.

Summary

The proposed hospital based single centered prospective cohort study was conducted in the department of Pediatrics, Asian Institute of Medical Sciences, Faridabad, India. This study was conducted for a duration of 6 months from October 2020 to March 2021. A total of 500 children were enrolled in this study of age group of 1-15 years visited in OPD and IPD of Department of Pediatrics of Asian Institute of Medical Sciences. There were 377 (75.40%) participants were male and 123 (24.60%) were female child. While the children were below 3 years 28 (5.60%), 3-6 years 84 (16.80 %), between 7-9 years were 211 (42.20 %), between 10-12 were 113 (22.60 %) and 64 (12.80%) belonged to 13-15 years of age group. There were 331(66%) participants were from urban type of residence and 33% participants belonged to rural area of residence. Majority 315 (63%) of the children belonged to nuclear family, 33 (6.6%) children belonged to extended family and 152 (30.4%) children belonged to joint family. More than 99% fathers were educated and 88% of mothers were educated. In the present study 12 (2.40%) children were from lower class of socioeconomic status, 68(13.60%) belonged to upper class but majority of participants 207(41.40%) belonged to lower middle and 172 (34.40%) participants belonged to upper middle class of socioeconomic status. It was seen that 359 (71.80%) mothers of children had mobile phone. But 500 (100%) fathers of children had mobile phone. 454 (90.80%) parents used smart phone device. While 449 (89.90%) parents have internet access on their mobiles. 241 (48.20%) parents used mobile for 1-3 hours and 78 (15.60%) parents were using mobiles for more than 3 hours per day. It had been that 500 (100%) children were using mobile phones of their parents. There were 265 children (53%) used their mother mobile phone and 235 children (47%) used their father mobile phone. Majority of children 302 (60.40%) were using mobiles for 1-3 hours followed by 119 (23.80%) children those who used mobile for less than 1 hours. Majority 158 (31.60%) of the children were using mobile for watching U-tube videos/app-based series, followed by 125 (25%) for playing games and 112 (22.4%) children were surfing internet. Following were the reasons to give mobile to children, majority 177 (35%) cases mobile was to quiteten down the children, 158(35%) had other reason like (child tantrums for mobile, child does not listen, to make show off in society etc.) and 93 (19%) believed that mobile phone would be helpful for their academics. Physical morbidities like headache in 426 (85%), pain in shoulder in 472 (94%), neck pain in 484(96%), wrist pain/pain in finger in 454 (91%), Frequent blinking of eyes in 425(85%) and watering from eyes in 419(84%) children were reported. Psychological morbidities like restlessness/ hyperactivity in 378 (76%), laziness in 421 (84%),

inability to sit at one place in 389 (78%), irritability/ tantrums in 398 (80%), depression in 436 (87%) and anxious in 447 (89%) children were reported. Social morbidities like delayed speech in 456 (91%), abnormal behavior in 420 (84%), delayed response to verbal command in 446 (89 %), features of autism spectrum disorder in 461(92%), poor scholastic performance in 458 (92%) and anti-social behavior in 472 (94%) children were reported. After 3-month intensive counselling; the physical effects like headache (85% *vs.* 66%; $p < 0.001$), pain in shoulder (94% *vs.* 79%; $p < 0.001$), Neck pain (95% *vs.* 86%; $p < 0.001$) wrist pain/pain in fingers (90% *vs.* 81%; $p = 0.001$) and watering from eyes (85% *vs.* 78%, $p = 0.03$) were significantly improved among children. The psychological effects like restlessness/hyperactivity (76% *vs.* 65%; $p = 0.002$), irritability (80% *vs.* 69%, $p = 0.002$) were significantly improved among children. Social effects like delayed speech (91% *vs.* 86%, $p = 0.04$), abnormal behavior (83% *vs.* 77%; $p = 0.02$), delayed response to verbal command (90% *vs.* 63%, $p < 0.001$), features of autism spectrum disorder (93% *vs* 83%, $p < 0.001$), poor scholastic performance (91% *vs.* 77%, $p < 0.001$) and anti-social behavior (94% *vs.* 74%, $p < 0.001$) were significantly improved among children. There were few limitations of our study like small sample size, single centered, more withdrawal and loss to follow up for intensive counselling due to COVID pandemics. So, in future, there will be large prospective population-based study is required to evaluate the adverse impact of mobile phone abuse and impact of cognitive behavior therapy on mobile phone addiction.

Conclusion

The present study concluded that the use of mobile phones by young generation has increased. The reasons are parental and social. The excessive use of mobile phones is having its physical, social, and psychological impact. It is the role of family to regulate the use and guide the children for proper usage of mobile phones. Apart from that, 3 months intensive counselling had improved the adverse effects of mobile phone abuse. So, we are recommending the early counselling of both children and parents to reduce the adverse impact of mobile phones.

Conflicts of Interest

(Includes financial disclosures): The authors have indicated they have no conflicts of interest relevant to this article to disclose.

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Dr. Vineetranjan Gupta and Dr. Arvind Gupta conceptualized and designed, drafted the initial manuscript and reviewed and revised the manuscript.

Dr. Vineetranjan, Dr. Shreyansh, Dr. Shikha Uppal, Dr. Srishti, Dr. Kavita. Dr. Gopal collected data, carried out initial analyses and reviewed and revised the manuscript.

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