Abstract: The phenomenon of pica has been described within the literature in many ways, from a socially acceptable practice to a life threatening behavior. Recent prevalence rates of pica indicate relatively low occurrence of this phenomenon that makes it difficult to easily identify trends in practices related to pica. Recent literature on pica (1990 to 2002) indicate a trend toward use of more reinforcement based procedures and less use of more intrusive procedures such as overcorrection, time-out and restraint as was reported in the literature prior to 1990. Most recent studies of pica appear to have an underlying basis in behavior analysis procedures for both assessment and intervention. It appears that recent literature indicates a trend toward frequent use of functional assessment procedures to identify the specific reinforcement involved with pica. This paper reviews some of the recent assessment procedures and treatments of pica based on different etiological models.

A fundamental component of life involves the ingestion of foreign substances into the body to be absorbed and used as a source of energy. Most babies are born with some ability to distinguish between tastes and recognize hunger, and, while these may be necessary skills, they may not be sufficient skills to differentiate between food and non-food items. The ability to distinguish what should be eaten and what should typically not be eaten is most likely a response class of learned behaviors that can become highly refined over time and help individuals vary distinct differentiations among potential food items. The phenomenon of pica has been described in many ways within the recent literature, from a socially acceptable practice to a life threatening behavior. Many factors have been identified as influencing eating behavior, which makes pica an interesting yet complex topic of research.

Pica has generally been defined as repeatedly eating objects with no nutritive value. The term pica has its origins in the Latin classification of the magpie, a bird that is known to scavenge both edible and non-edible items (Tewari, Krishnan, Valsalan, & Roy, 1995). Pica is not a newly recognized phenomenon, but appears to have been recognized for centuries, as can be noted by its presence as part of some religious practices such as anthrophagy in Christianity. Historically, many medical terms have been used to refer to deviations in appetite or cravings for specific substances, including picatio, picacia, pseudorexia, malacia, citta, allotriophagia, hapsicoria, pellacia, geophagia, and geomania (Parry-Jones & Parry-Jones, 1992).

Occurrences of pica or deviations in appetite were first reported as early as the Greeks and Romans in the 16th Century, with higher prevalence rates found among young children and pregnant women (Parry-Jones & Parry-Jones, 1992). Pica is still a phenomenon that is reported frequently within the literature and encompasses a multitude of specific topographies (see Table 1). Pica may involve either nonfood items or food items that are consid-
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<th>Study</th>
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<th>Prevalence (%) (male to female ratio)</th>
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<td>Tewari et al. (1995)</td>
<td>Eating non-food items &amp; inappropreate food items (ice cold, frozen food, &amp; food discarded in trash or on floor)</td>
<td>Information solicited from senior nursing staff</td>
<td>Learning Disability Hospital (246)</td>
<td>Learning disabled, adults (24–79 years), minimum 2 years stay in hospital</td>
<td>10.1% (1.4:1 for those identified with pica)</td>
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<td>Bhandari &amp; Agarwala (1996)</td>
<td>Not Stated</td>
<td>Self-report, 5 item questionnaire</td>
<td>Co-educational School in India (500)</td>
<td>School age, otherwise not stated</td>
<td>6% (1.6% with duration of 2–4 years)</td>
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<td>Lohiya et al. (1996)</td>
<td>Not Stated</td>
<td>Not Stated</td>
<td>Institution (323; 66)</td>
<td>Mental retardation</td>
<td>77% (250 of 323 in 1977; 16.7% (11 of 66 in 1994)</td>
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<td>Tracy et al. (1996)</td>
<td>Habit of putting objects in mouth indiscriminately</td>
<td>Elgin Behavior Rating Scale (EBRS)</td>
<td>State Hospital (400)</td>
<td>Schizophrenia Disorder (any subtype), adults</td>
<td>3%</td>
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<td>Applegate, Matson, &amp; Cherry (1999)</td>
<td>Not stated, but not co-occurring with SIB, stereotype, aggression, or rumination</td>
<td>Not Stated</td>
<td>Developmental Center (417)</td>
<td>Severe or profound mental retardation</td>
<td>7.2% (24 male &amp; 6 female; age range 24–79 for those identified with pica)</td>
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<td>Matson &amp; Bamburg (1999)</td>
<td>DSM-IV criteria</td>
<td>Psychological &amp; functional assessment</td>
<td>Institution (790)</td>
<td>Mental retardation, age range from 17 to 80 years</td>
<td>5.7%</td>
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<td>Rowland (1999)</td>
<td>Not specifically stated, but referred to as a generalized tendency to ingest or “bolt” to food related substances</td>
<td>Gleaned from screening data regarding aberrant eating behaviors</td>
<td>Residential Learning Disability Facility (110)</td>
<td>Learning disabled, adults (age range 21–65 years)</td>
<td>15.4% (8 individuals identified with co-occurring polydipsia)</td>
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<td>Swift et al. (1999)</td>
<td>Frequent consumption of non-food and food related substances</td>
<td>Survey questionnaire, verbal questioning, and/or review of medical problems</td>
<td>Residential Facility (689)</td>
<td>Developmentally disabled adults</td>
<td>22.1% (1.5:1 ranging in age from 24 to 77 years for those identified with pica)</td>
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</tbody>
</table>
ered inappropriate for consumption due to lack of preparation, decomposition, or that do not have sufficient caloric value to maintain physical health. Eating nonfood substances has been observed in both animals and humans. Grazing herds of cattle have been noted to engage in eating of bones (osteophagia; Parry-Jones & Parry-Jones) and domestic cats have also been observed to engage in pica (Bradshaw, Neville, & Sawyer, 1997).

Pica may involve generalized items (Danford & Huber, 1982) and discrete classes of items such as tobaccophagia (Piazza, Hanley, & Fisher, 1996). Danford and Huber described 36 different types of pica, including both food and nonfood items. Some of the specific pica substances ingested by humans include: paint, plaster, hair, (Hakim-Larson, Voelker, Thomas, & Reinstein, 1997); ice, grass, vinegar, sand, leather, urine, chalk (Parry-Jones & Parry-Jones, 1992); dirt (Goldstein, 1998); and live wasps (Danford & Huber).

Some historical causative explanations of pica include: (a) retention of impure blood due to cessation of menses during pregnancy, (b) delayed development of sexual organs (chlorosis), (c) digestive disorders, (d) iron deficiency, (e) cosmetic reasons, such as to achieve pale skin, (f) sexual frustration, and (g) tight-corseting (Parry-Jones & Parry-Jones, 1992). Although not consistent for all types, pica has been related to factors such as seasonal changes, age, level of mental retardation, and aggression (Danford & Huber, 1982). Some associated detrimental symptomologies of pica reported were lead poisoning (Boris, Owen, & Steiner, 1996), choking (Hakim-Larson et al., 1997), and parasites (Foxx & Martin, 1975).

Some reported treatments for pica, that could be considered unusual, have included vomiting, purging, iron therapy, mineral baths, absinthe and oil figs, ingestion of difficult to digest foods, physical beatings, iron masks, and decapitation (to discourage others from the practice; Parry-Jones & Parry-Jones, 1992). That some of these treatments appear so drastic demonstrates the potential severity of the problem and its resistance to treatment or spontaneous remission. While many of these unusual treatments still occurred in the 20th century, more recent approaches using less intrusive procedures have been demonstrated as effective and will be discussed.

**Diagnosis**

Parry-Jones and Parry-Jones (1994) reported that pica was consistently identified for two millennia as a false or craving appetite or deliberate ingestion of bizarre food, nonnutritive substances, and/or non-food items. Prior to the 20th Century, pica was not typically recognized as an independent disorder (Hakim-Larson et al., 1997). Pica has commonly been included as a symptom of other diagnoses such as anorexia nervosa, bulimia, and rumination, all of which involve deviations in the typical ingestion of food (Parry-Jones & Parry-Jones). The DSM-IV diagnostic criteria for pica include persistent eating of nonnutritive substances for at least one month, which is considered developmentally inappropriate, and with sufficient severity to warrant independent attention from other disorders (APA, 1994).

The DSM-IV diagnostic criteria for pica indicate a differentiation based on cultural variables. Paniagua (2000) described this inclusion of specific cultural information as relatively uncommon within the DSM-IV and indicated that too much emphasis can be placed on these cultural variables, which may result in failure to identify severe psychiatric disorders. Extending Paniagua’s point specifically to pica could lead to failure to provide treatment for behavior that can be life-threatening.

Recommendations have been made to return to classifying pica as a symptom of some other more predominant disorder or condition, while expanding the definition of pica to include subtypes (Parry-Jones & Parry-Jones, 1992, 1994). One specific subtype recommended included excessive cravings for specific foods that are typically considered non-nutritive and low calorie, such as vinegar, spices, or pickles. The rationale for this specific subtype is that it would broaden the definition of pica and potentially encourage studying the relationship of pica with other eating disorders.
Etiology

Research on etiology of pica is limited and typically found under the broader category of eating disorders. Identifying pica as an independent disorder rather than as a symptom associated with other conditions such as eating disorders is different from classification systems used prior to the 20th Century (Hakim-Larson et al., 1997). Most etiological explanations recognize that pica may be multifactorial in origin, including medical explanations such as parasite infestation, inappropriate levels of digestive enzymes or acid levels in stomach, and iron deficiency (Parry-Jones & Parry-Jones, 1992).

Cognitive models of eating disorders have typically focused on three major areas involving disordered sensations of hunger and satiety, conceptual distortions, and perceptual distortions primarily of body image (Mitchell & McCarthy, 2000). Marchi and Cohen (1990) suggested that lack of self-control may be an underlying factor of pica. This suggestion was based on their longitudinal research findings that young children who were picky eaters (representing more self-control) did not develop bulimia in adolescence and that pica behavior in young children (representing a lack of self-control) was correlated with adolescent development of bulimia.

The psychodynamic model explains eating disorders such as pica based on conflicts of unconscious thoughts/feelings as an impetus for the psychopathology. Goldstein (1998) described a case study involving a 33-year-old African American woman who, with no formal psychiatric history, engaged in eating dirt. Although the woman was from a culture in the West Indies known to ingest dirt, it was speculated that the pica was based on two types of unresolved conflict, primarily shame and loss. The shame aspect involved her relationship with her parents and feelings that she was doing something considered “dirty” and unacceptable to her parents. The loss aspect involved repeated miscarriages and her statements about wanting to put some of the fetus back inside herself by eating dirt from the gravesite. The woman did not participate in any treatment.

Lastly, the multidimensional model used to explain eating disorders emphasizes that no single factor operates to maintain or trigger the problems associated with eating disorders (Mitchell & McCarthy, 2000). This model integrates both external and internal factors associated with an individual including social, biological, psychological, and familial influences that contribute within a developmental framework to explain the causes of eating disorders (Bryant-Waugh & Lask, 1995).

Although considerable research has been conducted on feeding and eating disorders, no clear pathogenesis has emerged (Hakim-Larson et al., 1997). One factor that appears most clearly associated with pica is iron deficiency (Parry-Jones & Parry-Jones, 1994). Most causal evidence suggests that eating disorders are produced and maintained through an interaction of a variety of factors previously discussed within individual models (Bryant-Waugh & Lask, 1995). Additional research regarding these interactions of factors may prove to facilitate the etiological understanding of pica.

Assessment

Pica has been assessed through a variety of methods such as “baiting” (Foxx & Martin, 1975; Piazza et al., 1998), use of placebo pica stimulus (Donnelly & Olczak, 1990), X-rays (Burke & Smith, 1999), component analyses (Piazza et al., 1996), and functional analyses (Hirsch & Myles, 1996; Piazza, Hanley, Blakeley-Smith, & Kinsman, 2000). Piazza et al. (1998) described baiting as placing nonfood items, identified by a medical team to be safe for mouthing or consumption, in an area where they could be observed and accessed by the person being assessed. Burke and Smith reported on a case study where X-rays along with staff reports were used to assess prevalence of pica in a 59-year-old male. X-rays were conducted on eight separate occasions over a four-year period during the case study and revealed the absence or presence of specific items ingested (nails). Piazza et al. (1996) described a component analysis that involved offering a 17-year-old male different parts of a cigarette to determine the specific cigarette component that maintained pica.

Other assessment methods have focused on identifying the function of pica behavior in the form of functional assessment. Functional
analyses based on procedures described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994) have been reported (Hirsch & Myles, 1996; Piazza et al., 1998) as well as use of brief functional assessment in an effort to understand the causal and maintaining variables associated with pica (Northrup, Fisher, Kahang, Harrell, & Kurtz, 1997). Indirect assessment measures have also been used (Goh et al., 1995; Piazza et al., 1996), especially when pica is presumed maintained by automatic reinforcement. Vollmer (1994) described numerous difficulties in conducting functional analyses on behaviors that are maintained by automatic reinforcement and suggested that assessment procedures be developed to identify specific sources of automatic reinforcement. It appears that one trend in the indirect methods described in the assessment of pica involves identification of specific sources of reinforcement. Goh et al. used indirect methods to demonstrate a preference for hand stimulation over mouth stimulation in a study of automatically reinforeced pica. Piazza et al. (1996) used a component analysis to demonstrate that nicotine was the specific source of reinforcement in cigarette pica. Applegate, Matson, and Cherry (1999) reported that the use of the Questions About Behavioral Function Scale may be an adequate means of assessing the function of behaviors that are typically associated with automatic reinforcement such as pica. The study also indicated that treatments including high levels of environmental stimulation, especially around meal and snack time, appear to be warranted.

Assessment of pica is an area that is continually developing and has become more refined through use of functional assessment procedures. These recent advances have begun to emphasize use of functional assessment procedures in identifying specific sources of reinforcement. Vollmer (1994) suggested that identifying the relative value of automatic reinforcement is an important step towards developing an understanding of the reinforcing value associated with these behaviors. Vollmer also encouraged more research demonstrating correlational relationships between problem behaviors and physical ailments. Several studies have reported that pica has been maintained by automatic reinforcement, so current assessment trends for pica appear to be compatible with suggestions made by Vollmer, along with correlations between pica and physical ailments which have been previously demonstrated (Pace & Toyer, 2000).

Treatment

Treatment of pica has changed since the first methods were reported in the 16th Century (Parry-Jones & Parry-Jones, 1994). As detailed by Parry-Jones and Parry-Jones (1992), these initial treatments usually involved recommendations to avoid preventing occurrence of the behavior for fear of causing more severe problems. These authors reported that it was sometimes thought that pregnant women or young children were providing themselves with supplements to their diets, which were needed to avoid nutritional deficiencies, or as a remedy for undiagnosed ailments. The trend toward avoiding reduction of pica behavior, based on the harm this might cause, has recently changed, and the detrimental effects of this behavior typically outweigh any potential benefits.

An additional evolution in the treatment of pica behavior may include use of functional assessment to determine function of the pica and training of replacement behaviors. Prior to incorporation of functional analysis procedures described by Iwata et al. (1982/1994), several studies demonstrated successful techniques for reducing pica. Use of brief physical restraint and a verbal reprimand was demonstrated as an effective treatment for the pica of two 6-year-olds (Bucher, Reykdal, & Albin, 1976). This study used actual food items as the pica items, although the food items were not considered appropriate to eat since the items were placed on the floor. This study also described a procedure that could be considered a possible health risk to implement (placing the child on the ground with the experimenter’s knee pressed lightly on the child’s back).

Foxx and Martin (1975) demonstrated the use of overcorrection procedures to reduce scavenging for pica items behavior of four adults diagnosed with mental retardation. Results of this study included a recognizable change in health status such as increase in appetites and body weight for three of the adults by freeing them from persistent intesti-
nal parasites that were maintained by coprophagy. These studies differ from more recent studies incorporating intrusive procedures such as punishment (e.g., Fisher, Piazza, Bowman, Kurtz, Herer, & Lachman, 1994) in that the procedures were not based on functional assessment procedures.

The following provides a review of some of the more recent procedures used in treatment of pica. These procedures are presented in a manner that attempts to group them according to the underlying etiological model that the treatments generally represent, although some treatments are based in a combination of etiological models. These treatments are also presented in Table 2 for reference purposes.

Medical Model

Successful treatment of pica has been demonstrated with medical interventions designed to treat associated conditions. Boris et al. (1996) reported the disappearance of pica in an 11-year-old African American male following treatment of hypersomnolence and lead poisoning with methylphenidate and chelation therapy. Pace and Toyer (2000) employed a B-A-B experimental design using the multivitamin Polyvisol® as the independent variable to reduce the latency to pica in a 9-year, 5-month-old female diagnosed with severe mental retardation, iron deficiency, and anemia. Pica was defined as placement of a non-food substance (cloth fragments, string, synthetic fibers) on or past the lips.

Beecroft, Bach, Tunstall, and Howard (1998) presented a case study of a 75-year-old woman diagnosed with schizophrenia and a 20-year history of pica. Her pica had historically consisted of Dexedrine and Vitamin C, and at the time of assessment consisted of tablets, coins, nuts, wire, plastic, “purple hearts”, Bob Martín’s dog, conditioning powder, and dried flowers. Treatment consisted of a medical and cognitive-behavioral approach that involved differential reinforcement of vitamin C consumption. Reinforcement involved encouragement, persuasion, a constant supply of vitamin C, and an attempt to provide a stress and confrontation-free environment. The treatment was judged as partially successful.

Behavioral Model

Treatments using behavior analysis techniques have been frequently reported in the literature. Pica has been addressed through single interventions such as: (a) vitamin supplementation (Pace & Toyer, 2000), (b) multiple component treatment packages (Fisher, Piazza, Bowman, Kurtz, Herer, & Lachman, 1994; Goh et al., 1999), (c) punishment (Fisher et al., 1994; Foxx & Martin, 1975; Matson, Stephens, & Smith, 1978), (d) protective equipment (Mace & Knight, 1986), and (e) response blocking and redirection (Hagopian & Adelinis, 2001).

Hagopian and Adelinis (2001) used response blocking and redirection with a 26-year-old man diagnosed with moderate mental retardation and bipolar disorder, who displayed multiple substance pica (paper, pencils, paint chips, and human feces). These authors found that physically blocking pica attempts alone increased the frequency of ag-
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<th>Experimental Design</th>
<th>Measure of Effectiveness</th>
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<tr>
<td>Beecroft et al. (1998)</td>
<td>Vitamin C consumption used as alternative behavior &amp; stress-free environment</td>
<td>Not clearly stated, but involved consumption of inedibles (coins, steel nuts, etc.) and efforts to gain access to such items</td>
<td>(1) 75-year-old female diagnosed with schizophrenia, living in residential care</td>
<td>Not conducted</td>
<td>Repeated X-rays and staff reports</td>
<td>Judged to be partially successful</td>
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<td>Bhandari &amp; Agarwala (1996)</td>
<td>Self-monitoring alone &amp; self-monitoring with progressive relaxation</td>
<td>Not stated, but referred to as morbid appetite for substances which are not food stuffs</td>
<td>(8) 4 males &amp; 4 females age 15–17 years, with self-reported engagement in pica for 2–4 years</td>
<td>Not conducted</td>
<td>Multiple treatment design, (AB) with follow-up probes</td>
<td>Both treatments independently produced zero self-reported occurrence of pica, but only self-monitoring with progressive relaxation maintained during follow-up probes</td>
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<td>Boris et al. (1996)</td>
<td>Methylphenidate &amp; chelation therapy</td>
<td>Not clearly stated, but described as putting inanimate objects in mouth twice</td>
<td>(1) 11-year-old black male with 4-year history of hypersomnolence &amp; chronic lead intoxication</td>
<td>Not conducted</td>
<td>Pre-intervention direct observation &amp; pre &amp; post intervention measures of blood lead levels</td>
<td>Unknown, initial reduction in blood lead levels upon treatment, but returned to unacceptable levels during follow-up probes</td>
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<tr>
<td>Burke &amp; Smith (1999)</td>
<td>Multiple environmental modifications (&quot;pica proofing&quot;, iron supplements, increased activities, discrimination training)</td>
<td>Staff reports of hoarding of small objects</td>
<td>(1) 59-year-old male identified with a psychiatric or developmental disorder</td>
<td>Not conducted</td>
<td>Case report</td>
<td>Staff reports of decreased hoarding and reduced foreign objects observed during 8 X-rays over a four year period</td>
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<tr>
<td>Study</td>
<td>Intervention Type</td>
<td>Methodology</td>
<td>Outcome</td>
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<td>Donnelly &amp; Olezak (1990)</td>
<td>Differential reinforcement of incompatible behavior (DRI)</td>
<td>Picking up a placebo pica stimulus (participants had been observed to not pick up pica items without attempting to ingest them)</td>
<td>(2) Adult males ranging in age from 38 to 44 years, diagnosed with mental retardation living in a residential facility Not conducted Single subject ABAB Latency to pica increased with intervention with concomitant reduction of pica to near zero levels, additional subject dropped from study following spontaneous remission of pica</td>
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<td>Goh, Iwata, &amp; Kahng (1999)</td>
<td>Differential reinforcement with alternative edibles</td>
<td>Placement of cigarette product past the plane of the upper and lower lips</td>
<td>(4) Three males and one female ranging in age from 40 to 49 years, diagnosed with severe to profound mental retardation Not conducted Multiple baseline across subjects Pica reduced for 3 of 4 participants by DRA with alternative edibles</td>
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<td>Hirsch &amp; Myles (1996)</td>
<td>Pica box (combination discrimination training &amp; redirection)</td>
<td>Stopping current activities to search for items to eat (i.e., diaper, mattress stuffing, rocks, dirt, grass, paper)</td>
<td>(1) 10-year-old girl diagnosed with pica and autism Functional analysis revealed pica was not used to escape tasks, to gain attention, or earn tangible rewards Single subject research, ABAB design Intervention resulted in a reduction in pica attempts</td>
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<td>Northrup et al. (1997)</td>
<td>Differential reinforcement of other behavior (DRO) and time-out</td>
<td>Any attempt to put inedible objects (paper, plastic, or smoking materials) in her mouth</td>
<td>(1) 35-year-old, nonverbal female functioning in the severe range of mental retardation Brief functional assessment revealed high rates across all conditions Multiple schedules design with reversals Treatment effective when implemented at 50% of initial treatment recommendations or higher (75% &amp; 100%)</td>
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<td>Pace &amp; Toyer (2000)</td>
<td>Multivitamin vitamin therapy</td>
<td>Placement of a nonfood substance on or past the lips</td>
<td>(1) 9-year-5-month-old girl diagnosed with severe mental retardation, iron deficiency, anemia Not conducted Single Subject, (BAB) An increase in latency to pica was observed with the use of multivitamin</td>
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<td>Piazza et al. (1998)</td>
<td>Noncontingent reinforcement</td>
<td>Placing a baited item or any other nonedible item past the plane of the lips</td>
<td>(3) Two females ages 4 &amp; 17, &amp; one male age 5 all diagnosed with mental retardation</td>
<td>Functional analysis—identified automatic and/or social reinforcement</td>
<td>Multielemental and reversal designs</td>
<td>Treatments based on hypothesized function of pica reduced rates of pica more than treatments unrelated to hypothesized function for two of three participants</td>
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<td>Piazza et al. (2000)</td>
<td>Search skills training (differential reinforcement of alternative behavior through independent access)</td>
<td>Placement of hands or clothes past the plane of the lips, or tongue contact to hands, clothes, walls, or floor</td>
<td>(1) 9-year-old boy diagnosed with profound mental retardation, plumbism, cortical blindness, and spastic quadriplegia, SIB was also displayed</td>
<td>Pica displayed persistently across all conditions of functional analysis for SIB</td>
<td>Single subject ABAB design</td>
<td>Treatment reduced %age of sessions with pica and increased %age of sessions with appropriate mouthing</td>
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<td>Piazza, Hanley, &amp; Fisher (1996)</td>
<td>Noncontingent reinforcement, response interruption, and stimulus control</td>
<td>Placing any part of a cigarette butt or pieces of a cigarette on or past the lips</td>
<td>(1) 17-year-old male diagnosed with severe mental retardation</td>
<td>Functional analysis using multi-elemental design identified automatic reinforcement</td>
<td>Multielemental design and reversal</td>
<td>Treatment reduced pica to zero and transfer to stimulus control produced zero rates of pica</td>
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<td>Piazza et al. (2002)</td>
<td>Alternative items and response effort</td>
<td>Placing one of the baited items from the session room past the lips</td>
<td>(3) 14 to 19-year-old females with severe mental retardation</td>
<td>Functional analysis using multi-elemental design identified automatic reinforcement</td>
<td>Multielemental design</td>
<td>Response effort analysis demonstrated a reduction in pica when alternative items were available</td>
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gression. However, redirection to an alternative preferred food item (popcorn) in conjunction with response blocking was effective in producing reduction in pica rates. Non-contingent access to popcorn alone did not suppress pica. Combined effects of blocking and redirection were determined to be necessary components of treatment. Piazza, Roane, Keeney, Boney, and Abt (2002) found a reduction in automatically reinforced pica behavior with three participants when alternative items were available. Their study varied the response effort associated with accessing pica items and alternative items. They found that the responses allocated toward pica or alternative items varied, based on amount of response effort necessary to access the items. More responses were allocated toward items with lower response effort for all three participants.

Goh et al. (1995) used a pica exchange procedure in which the individual was taught to turn inedible items over to staff in exchange for highly preferred edible items. Results indicated that for three of four participants, offering a highly preferred edible reinforcer contingent on the individual turning in cigarette butts to staff was effective in reducing overall pica rates. Prior to implementation of the pica exchange, a multi-component preference assessment was conducted to determine which properties of cigarettes were reinforcing for each of the four individuals. For one of the individuals, alternative food items were not preferred over cigarettes, and therefore it was determined that pica exchange would not be an effective treatment for this individual.

The strength necessary to effectively maintain low levels of pica with differential reinforcement of an alternative behavior (DRA) and a brief time-out were assessed using an experimental design for a 35-year-old female functioning in the severe range of MR (Northrup et al., 1997). Pica was defined as her attempt to put inedible objects (paper, plastic, or smoking related materials) in her mouth. Results of the study indicated that pica was successfully maintained at low levels with 50% implementation of the time-out procedure. This study suggests that DRA and brief time-out may be an effective treatment for pica even when implemented at less than a continuous schedule and that fading of treatment for pica might be done more rapidly than had been previously demonstrated.

Piazza et al. (1996) demonstrated that pica behavior could be placed under stimulus control by associating a purple card with treatment using noncontingent reinforcement and response interruption. Cigarette butt pica of a 17-year-old male with severe MR was reduced to zero across multiple environments when he was provided free access to edibles, environmentally associated activities, and a purple card. Pre-treatment assessments conducted in the study revealed: (a) nicotine as a factor maintaining pica (over herbal cigarettes), (b) preference for tobacco over other parts of a cigarette, and (c) automatic reinforcement as a maintaining variable. The study also described an example of covert pica that involved hiding pica items in shoes, under arms, or in pockets for later consumption.

Piazza et al. (1998) conducted a study of three participants’ (two females and one male ranging from 4 to 17-years of age) pica behavior that revealed that automatic reinforcement was primarily responsible for one participant’s behavior and partially responsible for the behavior of the other two participants. Treatments based on the hypothesized functional topography of oral stimulation were more effective than treatments unrelated to hypothesized function for two participants.

Piazza et al. (2000) trained a blind boy with profound MR to search out and independently access alternative sources of reinforcement to replace pica behavior. The boy was 9-years-old and had been diagnosed with profound MR, spastic quadriplegia, plumbism (lead poisoning), and cortical blindness. Pica was defined as placement of hands or clothes past the plane of the lips, or tongue contact to hands, clothes, walls, or floor. The training consisted of 12 sessions of direct instruction in the use of strings used to locate appropriate mouthing toys. The direct instruction was faded until the participant independently accessed the toys via use of the strings as guidance. This training reduced the pica to near zero within an A-B-A-B experimental design, while increasing what was considered appropriate mouthing of toys.
Summary

Donnelly and Olczak (1990) stated that the most frequently reported interventions in the literature for pica were time-out, restraint, and overcorrection, although they reported a recent overall trend toward using less restrictive interventions. A limited review of the literature on the treatments for pica from 1990 to 2002 does not indicate a continuation of frequent reports of those treatments noted by Donnelly and Olczak. In contrast, the trend in treatment of pica most recently indicates a movement toward the use of more alternative reinforcement procedures, matching the recent trend reported by Donnelly and Olczak. A rationale for this trend may be the result of a more widespread use of functional assessment procedures paired with less restrictive interventions and recognition of effective procedures that are less time intensive. The trend toward using less restrictive interventions in the treatment of pica may have developed more slowly than treatments for other topographies of behavior, possibly due to low prevalence rates of the behavior with recent prevalence rates ranging from 3 to 22% (Swift et al., 1999; Tracy, de Leon, Ghayyur, McCann, McGrory, & Josiassen, 1996). Less restrictive treatments for pica may have been slower to develop due to difficulties inherent in treating behaviors considered to be maintained by automatic reinforcement.

Burke and Smith (1999) suggest that additional research is needed to examine the effects of procedures that consider the least intrusive options available. They presented a case study which utilized a number of environmental controls including “pica proofing” and administration of an iron supplement along with discrimination training to reduce the pica of a 59-year-old male identified with a psychiatric or developmental disorder, which was maintained at a 5-year follow-up.

Treatments reviewed for pica represent several different underlying etiological models, with the most frequently reported treatments having an underlying basis in a behavioral model. The behavioral model, by including the use of functional assessment techniques, appears to have some potential for addressing the underlying assumptions of many models. Functional behavioral assessment can provide evidence of: (a) underlying medical conditions, (b) problems with social interactions as typically referred to in a familial model, and (c) discrimination problems that could be interpreted as cognitive dissonance within a cognitive model.

Pica has a long history of occurrence with a multitude of topographies being described. Considering recent prevalence estimates (from 3 to 22%), it would appear that current research literature provides a proportional reflection of the treatment actually being provided, although current research may not be an accurate reflection of the efficacy of interventions presented in published studies. As pointed out by Vollmer (1994), success rates of treatments based on automatically reinforced behavior may be lower than a review of the literature might suggest because treatment failures are not usually reported.

Current trends in assessment appear to include evaluation of specific sources of reinforcement as suggested by Vollmer (1994) as well as incorporation of more indirect methods that indicate correlational relationships. These forms of assessment, coupled with use of less intrusive interventions that involve multiple environmental manipulations provided in the form of treatment packages, have become the norm with regard to treating the condition. Future research involving pica may incorporate more emphasis on the histories of reinforcement involved in the development of the phenomenon and possibly the effects of both proximal and distal variables on the occurrence of pica.

References


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