



Screening for Autism Spectrum Disorders in Toddlers Using the M-CHAT

Lauren Herlihy, M.A.

Early Detection of Pervasive Developmental Disorders Study

Department of Psychology

University of Connecticut, Storrs, CT

Webinar

Date

University of Louisville

Funding

- Development and revision of the M-CHAT and M-CHAT-Revised (Deborah Fein, PI) is supported by the National Institute of Child Health and Human Development.



Early Detection Study- Collaborators

Georgia State University

Diana Robins, Ph.D. (first author of M-CHAT)

Yale University

Tammy Babitz, M.A.

Katarzyna Chawarska, Ph.D.

Ami Klin, Ph.D.

Fred Volkmar, M.D.

National Institutes of Health – Tokyo

Yoko Kamio, M.D.

University of Washington

Geraldine Dawson, Ph.D. (now at Autism Speaks)

Karen Toth, Ph.D.

Wendy Stone, Ph.D.

UConn Collaborators

- Faculty:
 - Marianne Barton, Ph.D.,
Director, Psychological
Services Clinic
 - Thyde Dumont-Mathieu, M.D.
 - James Green, Ph.D.
 - Sarah Hodgson, Ph.D.
 - Jamie Kleinman, Ph.D.
- Graduate Students:
 - Laura Brennan
 - Katelin Carr
 - Colby Chlebowski
 - Alex Hinnebusch
 - Kelley Knoch
 - Eva Troyb
- Research Assistants:
 - Katie DeYeo
 - Sarah Hardy
 - Courtney Manning

Abbreviations

- M-CHAT= Modified Checklist for Autism in Toddlers (Robins et al., 2001)
- ASD= Autism spectrum disorder, including:
 - Autistic Disorder
 - Asperger's syndrome
 - Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS)
- EI= Early Intervention
- AAP= American Academy of Pediatrics

Why routinely screen for ASDs?

- Screening improves detection of children at risk
- Detection leads to diagnosis
- Diagnosis leads to services
- Services lead to improved outcome



Screening improves detection of children at risk

- The use of more informal, non-validated screening strategies leads to an unacceptably low sensitivity of 20-30%.
- Screening strategies can include the use of specific red flags during observation, as well as validated parent-report screeners.

Detection leads to diagnosis, but is early diagnosis valid?

- Diagnosis of ASD can be reliably made before age 2 (our sample is 16-30 months)
- Clinical judgment is still the best, but ADOS and CARS work well at that age
- Most diagnostic movement between age 2 and 4 is toward improvement
- Children with provisional diagnosis at age 2 because of severe delays overwhelmingly meet criteria for ASD at age 4

Diagnosis leads to services

- Most EI programs require a diagnosis before autism intervention is begun
- Some EI programs do their own diagnosis; many do not



Services lead to improved outcome

Early detection and early intervention can lead to substantially better prognosis, including:

- improved language,
- improved social relationships,
- Improved adaptive functioning,
- fewer maladaptive behaviors,
- increased chance for successful inclusion
- **loss of diagnosis**

(Harris & Handleman, 2000; Howard et al., 2005; Lord & McGee, 2001; Myers, Johnson et al, 2007; Rogers, 1998; Sallows & Graupner, 2005)

Nationwide Screening Recommendations

- AAP (Gupta et al., 2007 in *Pediatrics*) recommends autism-specific screening at 18 and 24 months, in addition to developmental surveillance and broadband screening at multiple ages.
- The Council on Children with Disabilities (Johnson & Myers, 2007) recommends routine ASD surveillance at every well-child visit complemented by ASD-specific screening at the 18- and 24-month visits.
- At present, this represents the approach most likely to detect children at risk for ASD at the earliest times

When should screening be done?

- Early screens (<18 months)
 - May be less sensitive & specific
 - Miss children who regress between 18-24 months, or with later onset
- Later screens
 - Delay diagnosis and intervention
- Current Consensus
 - Screen twice



Comparison of Screening Instruments

J Autism Dev Disord

Table 1 Level 1 screens for autism spectrum disorders in young children

| Measure | Age (months) | Format | Time required | Sample | Sensitivity | Specificity |
|----------|--------------|--|----------------------|-------------------------------|-------------|-------------|
| CHAT | 18–24+ | Parent questionnaire; Professional observation | 5 min; Unclear | Population | 0.18–0.38 | 0.98–1 |
| M-CHAT | 16–30 | Parent questionnaire | 5–10 min | Mixed population and clinical | 0.87* | 0.99* |
| CHAT 23 | 18–24*** | Parent questionnaire; Professional observation | 5–10 min 5 min | Clinical | .84 .74 | .85 .91 |
| ESAT | 14–15 | Parent questionnaire; Clinician observation | 5–10 min; Unclear | Population | nr | nr |
| PDDST-II | 12–24 | Parent questionnaire | 10–15 min | Clinical | .92 | .91 |
| FYI | 12 | Parent questionnaire | 15+ min | Clinical | nr | nr |
| DBC-ES | 20–51 | Parent questionnaire | 5–10 min | Clinical | .83 | .48 |
| ITC | 9–24 | Parent questionnaire | 5–10 min | Mixed population and clinical | .93 | nr |

* Estimated

** With follow-up interview

*** Mental age

(Barton, Dumont-Mathieu, & Fein, in press, *JADD*)

Definitions

- Sensitivity: % of cases that screen positive
- Specificity: % of noncases that screen negative
- **Positive predictive value: % of screen positives that are cases**
- Negative predictive value: % of screen negatives that are noncases
- **Sensitivity** of a measure is of greatest concern to the primary care provider.
 - To detect the maximum number of children with the disorder, threshold for identification may be set low
 - This will result in the identification of more children with the disorder (high sensitivity), as well as a significant number of false positives (low specificity).

M-CHAT Procedures

- Children ages 16-30 months screened at pediatrician's office or by EI provider
- Researchers score M-CHAT
 - Positive screen (2 critical or 3 total items failed)
- Scripted phone follow-up for positive (failed) screens
- Clinical evaluation for those who continue to screen positive after phone follow-up
- Rescreen entire sample at 4
- Evaluate at 4
 - All those evaluated at 2,
 - New screen positives at 4,
 - Any child referred for, or diagnosed with, a PDD (asked on the 4-year-old screen)

Modified Checklist for Autism in Toddlers (Robins, Fein, Barton, Green, 2001)

- Adapted from the Checklist for Autism in Toddlers (CHAT; Baron-Cohen, Allen, & Gillberg, 1992).
- 23-item yes/no parent-response checklist
- Follow-up scripted interview for failed items reduces false positives
- Tested on 16-30 month olds
- About 18,000 children screened in our study
- Translated into multiple languages, used in many countries
- Available at www.mchatscreen.com (42 translations, scoring, free download)

Psychometric Properties of the M-CHAT

- Strong internal consistency (Cronbach's alpha= .87)
- Positive predictive value greatly increases with the use of the Follow-up Interview™
- Rationale for Scoring Criteria:
 - Odds of a child being diagnosed with ASD increases exponentially along with the number of items failed on the M-CHAT
 - Cut-off of 3 items failed reflects the greatest increase in ASD diagnosis from 2 to 3 failed items

PPV for UConn and GSU data

| | GSU | | | UConn | | | Total | | |
|--------------------------------------|------------------|----------------------------|---|------------------|----------------------------|---|------------------|----------------------------|---|
| | ASD Diagnosis | Any DSM-IV Diagnosis | Non-DSM IV Developmental Concerns | ASD Diagnosis | Any DSM-IV Diagnosis | Non-DSM IV Developmental Concerns | ASD Diagnosis | Any DSM-IV Diagnosis | Non-DSM IV Developmental Concerns |
| M-CHAT only | .05 | .08 | .09 | .06 | .11 | .12 | .06 | .09 | .11 |
| M-CHAT and M-CHAT Interview | .51 | .83 | .96 | .56 | .93 | .99 | .54 | .89 | .98 |

- N= over 18,000 children screened at both site, at either 18 or 24 months
- Strong internal consistency (Chronbach's alpha= .87)

(Chlebowski et al., in prep)

Current Issues in M-CHAT Screening

- Is screening twice (at 18 and 24 months) necessary?
- Are the 18 and 24 month screens equally effective?
- Are there disparities in ASD screening practices?

M-CHAT Items

(Robins et al., 2001)

1. Does your child enjoy being swung, bounced on your knee, etc.?
2. Does your child take an interest in other children?
3. Does your child like climbing on things, such as up stairs?
4. Does your child enjoy playing peek-a-boo/ hide-and-seek?
5. Does your child ever pretend, for example, to talk on the phone or take care of a doll or other pretend things?
6. Does your child ever use his index finger to point, to ask for something?
7. Does your child ever use his index finger to point, to indicate interest in something?
8. Can your child play properly with small toys without just mouthing, fiddling or dropping them?
9. Does your child ever bring objects over to you to show you something?
10. Does your child look you in the eye for more than a second or two?
11. Does your child ever seem oversensitive to noise, e.g. plugging ears?
12. Does your child smile in response to your face or smile?
13. Does your child imitate you? (e.g. you make a face - will your child imitate it?)
14. Does your child respond to his/her name when you call?
15. If you point at a toy across the room, does your child look at it?
16. Does your child walk?
17. Does your child look at things you are looking at?
18. Does your child make unusual finger movements near his/her face?
19. Does your child try to attract your attention to his/her own activity?
20. Have you ever wondered if your child is deaf?
21. Does your child understand what people say?
22. Does your child sometimes stare at nothing or wander with no purpose?
23. Does your child look at your face to check your reaction when faced with something unfamiliar?

M-CHAT Items as Predictors of ASD

Best discriminators of ASD from total sample:

- Pointing to show interest
- Responds to name
- Interest in other children
- Bring to show
- Follows point
- Imitation
- Reciprocal smile

M-CHAT Follow-up Interview™

- Tool to be used in conjunction with the M-CHAT to increase confidence in referral for ASD-related concerns
- Administered over the phone or in person to probe individual M-CHAT items in greater depth
- Provides greater explanation of items and multiple examples
- Requires some clinical judgment; administered by trained staff

Current Issues in M-CHAT Screening

- Is screening twice (at 18 and 24 months) necessary?
- Are the 18 and 24 month screens equally effective?
- Are there disparities in ASD screening practices?

Is Screening Twice Necessary?

- Younger (16-23 mo.) vs. older (24-30 mo.), high- and low-risk toddlers
- Parents of younger/low-risk children were most likely to refuse evaluation
- Older and younger toddlers had similar symptomatology and developmental delays
- For high-risk groups, and older/low-risk group, predictive power for ASD is adequate
- For younger/low-risk group, predictive power for detecting a developmental disorder is good, but with less specificity for ASD – may be picking up more mild, transient delays, or other disorders

Pandey, et al., 2008, in *Autism: The International Journal of Research and Practice*)

Are the 18 and 24 month screens equally effective?

- Dual screening will have the highest sensitivity.
- Between the two ages, the 24 month screen appears to be more valid for the M-CHAT and may meet with less resistance.
- Will providers be willing to do the 24 month screen if the 18 month screen is negative, or yields many false positives?

Are there disparities in screening for ASD?

- Referral, diagnosis, and treatment may be late or reduced for:
 - Minority children, particularly Hispanic children (CDC, 2006; Mandell et al, 2002; Mandell and Novack, 2005)
(Evidence for Black children is more mixed)
 - Low SES children
 - Children with less severe symptoms and delays (Liptak et al, 2008; Mandell, Novack, Zubritsky, 2005)
- There is more data on age of diagnosis than age of screening
- Screening is less consistent and later for children who are:
 - Ethnic minorities or Low SES, compared to children from middle class and non-minority families (Mandell, et al., 2002; Pinto-Martin, et al., 2005; Williams & Brayne, 2006; Zwaigenbaum et al., 2007, but see Wiggins, Baio, & Rice, 2006).
- Use of formal screening instruments increases sensitivity (Sices et al, 2003) and may reduce ethnic and SES bias.

Racial/ethnic and Linguistic Differences in Caregiver Responses on the M-CHAT

Screen positive children in Connecticut

- Minority vs. White
- No difference in M-CHAT score by ethnicity
- No sig. difference in PPV of total score
- 3 items differed on M-CHAT but not Follow-up Interview™
 - Unusual finger movements
 - Interest in peers
 - Eye contact

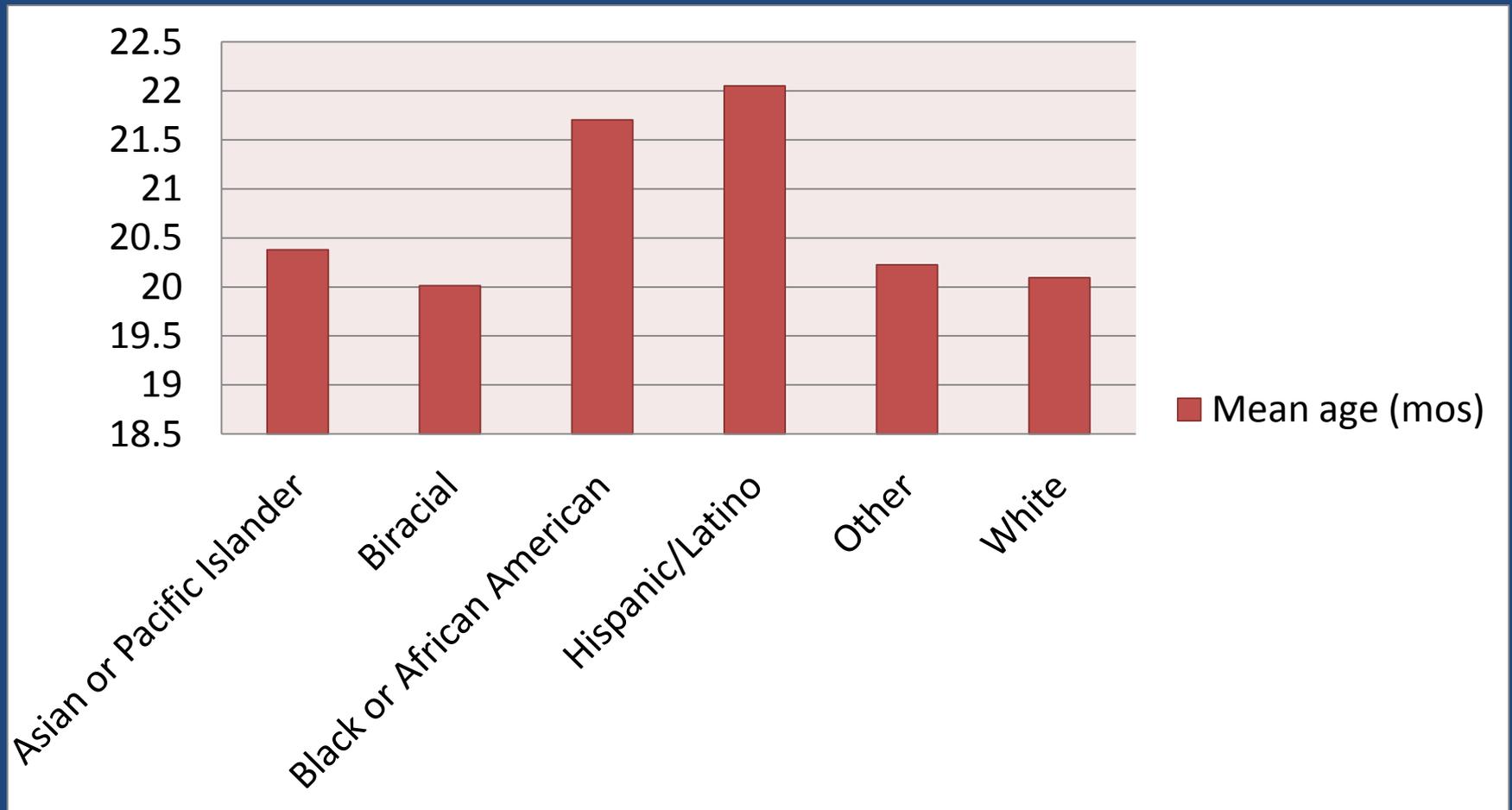
Screen positive children in Atlanta

- African-American vs. White
- **4 items** endorsed more often by African-American parents after controlling for mother's education:
 - Mouthing objects
 - Unusual finger movements
 - Does not attract caregiver's attention
 - Wanders with no purpose
- Follow-up Interview™ eliminated ethnic disparity

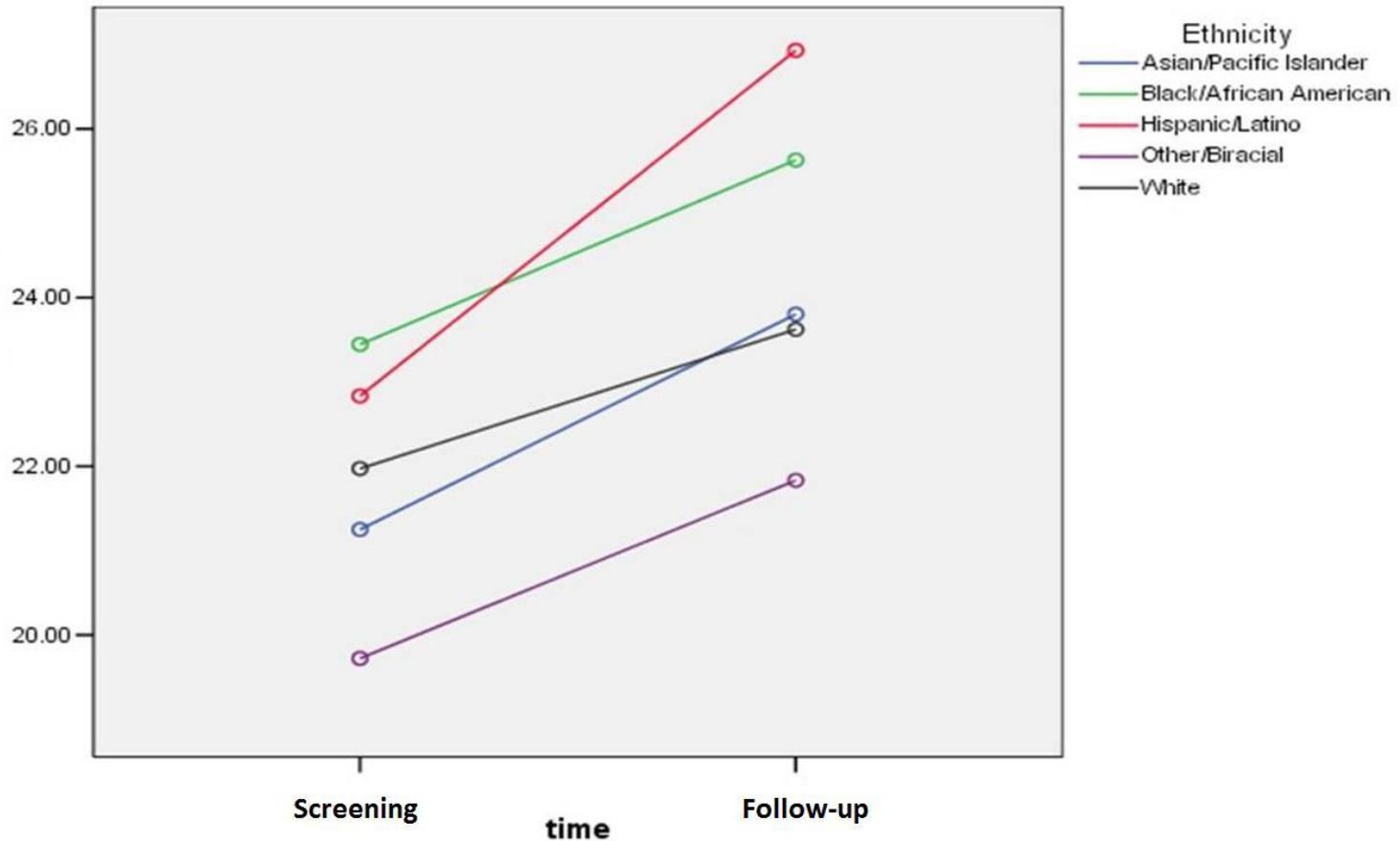
(Oliver, Robins, & Hazzard, 2009, presented at IMFAR)

(Dancel et al., 2008, presented at INS)

Mean age of screening in mos. by ethnicity



Interval Between Screening and Follow-up by Ethnicity



(Herlihy et al., 2011, presented at INS)

Conclusions

- Disparity in initial screening age persists
- PPV for White and Minority children was not sig. different.
- There are item discrepancies which are largely resolved by Follow-up Interview™
- There are disparities in time of screening, even when participating in a research study with prescribed protocol
- There are increasing disparities after a positive screen, esp. with Hispanic/Latino families
- Overall performance of M-CHAT is similar between groups

M-CHAT and M-CHAT Follow-up Interview™ Administration

Administering the M-CHAT Screening Questionnaire

M-CHAT Items

1. Does your child enjoy being swung, bounced on your knee, etc.?
2. Does your child take an interest in other children?
3. Does your child like climbing on things, such as up stairs?

M-CHAT Items

4. Does your child enjoy playing peek-a-boo/ hide-and-seek?
5. Does your child ever pretend, for example, to talk on the phone or take care of a doll or pretend other things?

M-CHAT Items

6. Does your child ever use his/her index finger to point, to ask for something?
7. Does your child ever use his/her index finger to point, to indicate interest in something?
8. Can your child play properly with small toys (e.g. cars or bricks) without just mouthing, fiddling or dropping them?

M-CHAT Items

9. Does your child ever bring objects over to you (parent) to show you something?
10. Does your child look you in the eye for more than a second or two?

M-CHAT Items

11. Does your child ever seem oversensitive to noise, e.g. plugging ears?

- Reverse-scored item (typical response is no)

12. Does your child smile in response to your face or your smile?

M-CHAT Items

13. Does your child imitate you? (e.g. you make a face - will your child imitate it?)
14. Does your child respond to his/her name when you call?

M-CHAT Items

15. If you point at a toy across the room, does your child look at it?

16. Does your child walk?

17. Does your child look at things you are looking at?



M-CHAT Items

18. Does your child make unusual finger movements near his/her face?

- Reverse-scored item (typical response is no)

19. Does your child try to attract your attention to his/her own activity?

20. Have you ever wondered if your child is deaf?

- Reverse-scored item (typical response is no)

M-CHAT Items

21. Does your child understand what people say?
22. Does your child sometimes stare at nothing or wander with no purpose?
 - Reverse-scored item (typical response is no)
23. Does your child look at your face to check your reaction when faced with something unfamiliar?

M-CHAT Critical Items

- Shows interest in other children (Item 2)
- Pointing to indicate interest (Item 7)
- Bringing objects to show (Item 9)
- Imitation (Item 13)
- Responding to name (Item 14)
- Follows a point (Item 15)

Scoring the M-CHAT

- Passing responses for each item:

1. Yes

2. Yes

3. Yes

4. Yes

5. Yes

6. Yes

7. Yes

8. Yes

9. Yes

10. Yes

11. NO

12. Yes

13. Yes

14. Yes

15. Yes

16. Yes

17. Yes

18. NO

19. Yes

20. NO

21. Yes

22. NO

23. Yes