1. CALL TO ORDER

The regular meeting of the Charter Township of Superior Board was called to order by the Supervisor Ken Schwartz at 7:00 p.m. on Monday, April 17, 2023, at the Superior Township Hall, 3040 North Prospect, Superior Township, Michigan.

2. PLEDGE OF ALLEGIANCE

Supervisor Schwartz led the assembly in the pledge of allegiance to the flag.

3. ROLL CALL

The members present were Supervisor Ken Schwartz, Treasurer Lisa Lewis, Trustee Nancy Caviston, Trustee Bernice Lindke, Trustee Rhonda McGill, and Trustee Bill Secrest.

Absent: Clerk Lynette Findley

4. ADOPTION OF AGENDA

It was moved by Trustee McGill supported by Treasurer Lewis, to adopt the agenda as presented.

The motion carried by unanimous vote.

5. APPROVAL OF MINUTES

A. MEETING DATE MARCH 20, 2023

It was moved by Trustee McGill supported by Trustee Lindke, to approve the minutes of the regular Board meeting of March 20, 2023, as presented.

The motion carried by unanimous vote.

B. MEETING DATE MARCH 31, 2023

It was moved by Trustee Lindke supported by Trustee McGill, to approve the minutes of the special Board meeting of March 31, 2023, as presented.

The motion carried by unanimous vote.

6. CITIZEN PARTICIPATION

A. CITIZEN COMMENTS

- Fred Lucas informed the Township residents and visitors of the process of rezoning in the Township, sited the Ordinance, and stated that the Board cannot at this time make comments, nor are they voting on the rezoning of 3900 Dixboro at this time.
- Mary Sutherland, Warren Rd., made comments opposing the rezoning of the property at 3900 Dixboro Rd.
- Felicia Brabec, State Representative, introduced herself, Representative Jason Morgan, Representative Jennifer Conlin, Representative Reggie Miller, and State Senator Sue Shink. She made comments in favor of the rezoning of the property at 3900 Dixboro Rd.
- Reggie Miller, State Representative, made comments in favor of rezoning of the property at 3900 Dixboro. Representative Brabec presented a letter of support from Washtenaw County Sheriff Clayton to the Board.
- Sue Shink, former County Commissioner, current State Senator, made comments in favor of rezoning of the property at 3900 Dixboro.
- Matthew Matuszak, Warren Rd., made comments opposing the rezoning of the property at 3900 Dixboro Rd.
- Shabnam Shidfar, Becky Ln., made comments opposing the rezoning of the property at 3900 Dixboro Rd.
- Margi Brawer, Fleming Ridge, made comments opposing the rezoning of the property at 3900 Dixboro Rd.
- Dr. Shelia Markus, child psychiatrist at University of Michigan, made comments in favor of the rezoning of the property at 3900 Dixboro Rd.
- Heidi Breton, Fox Hallow Ct., made comments opposing the rezoning of the property at 3900 Dixboro Rd.
- Dr. Michele Heisler, primary care physician, made comments in favor of the rezoning of the property at 3900 Dixboro Rd.
- Mike Dubin, Fleming Ridge, made comments opposing the rezoning of the property at 3900 Dixboro Rd.
- Stephen Henley, Warren Rd., made comments opposing the rezoning of the property at 3900 Dixboro Rd.
- Steve Preston, Fleming Ridge, made comments opposing the rezoning of the property at 3900 Dixboro Rd.
- Doug Dail, Wing Drive, made comments opposing the rezoning of the property at 3900 Dixboro.

7. PRESENTATIONS AND PUBLIC HEARINGS

A. DISCUSSION ON PATHWAY ALONG MACARTHUR BETWEEN HARRIS & STAMFORD – CLAIRE MARTIN

Claire Martin, OHM, gave the following updates:

- The pathway is designed and permitted.
- Crosswalk construction is nearing completion.
- Described options for proceeding with pathway.
    1. Community Development Block Grant (CDBG) - per Tara Cohen at the Washtenaw Office of Community and Economic Development, Block Grant funding would be $133,591.00 and would be available in August or September. The grant is through HUD and would require an environmental study and public bidding.
    2. Continue with ASI and use Township funds.

Supervisor Schwartz reported he and Clerk Findley have been in contact with Tara Cohen and have asked that all remaining funds in the current Block Grant be applied to the MacArthur Blvd. projects. Clerk Findley, Treasurer Lewis, and he plan to meet with Tara in a week.

Supervisor Schwartz asked the Board if they want to use the Block Grant option.

There was verbal agreement by all present Board members.

- OHM will need to provide a proposal for construction administration and bid book for the pathway.
- ADA ramps were resubmitted to TAP, still waiting for an answer.
- Geddes still on track for spring of next year.
- The Plymouth Rd Pathway still needs one easement.
- AT&T is relocating lines along the pathway.

Trustee Lindke asked where the cross walk to the park is located.
Claire Martin answered just west of the park.

8. REPORTS

A. SUPERVISOR REPORT

Supervisor Schwartz reported on the following:

- The Township needs an alternate for the Washtenaw Area Transportation Study (WATS) Committee.

It was moved by Trustee Lindke supported by Trustee McGill to appoint Treasurer Lewis as alternate to the WATS committee.

The motion carried by unanimous vote.

- The Township needs to do soil testing at the site for the Community Garden, he will get bids for Phase 2 testing of the soil.
- Garett's Space: Pre-development meeting on April 19, 2023, and Public Hearing on April 26, 2023.

B. LIAISON REPORT ON PARKS & RECREATION COMMISSION MEETING

Trustee Lindke reported on the following:

- The Commission is recommending payment to liaisons for attending meetings, that the payments come from the General Fund, and that a comprehensive policy for liaisons be written.
- It was decided to present a budget amendment to the General Fund to cover the increase in pay to Juan Bradford due to a shift from part-time to full-time.
- Proposal for equipment, walking trail, and fencing for Fireman's Park. The cost would be $218,000.00 and come from ARPA Funds.
- Easter Egg Hunt took place on April 2, 2023.
- The estimate for a dedicated restroom for Parks and Recreation staff at Fire Station 2 is approximately $51,000.00. Juan Bradford is to contact the Fire Chief to find out if there is an egress the Parks and Recreation staff can use to access one of the existing restrooms.

C. COMMUNITY CENTER ADVISORY COMMITTEE

Minutes from April 6, 2023, meeting was presented at the table.

Trustee Lindke relayed the following from Clerk Findley:

- There is a lot of strong support for the Community Center.
- Administrator Greg Dill gave an update at the meeting on April 6, 2023, in which he stated approximately two thirds of the funding for construction has been ~~allocated~~ identified.

D. ARPA FUNDS COMMITTEE

Trustee McGill reported on the following:

- The Committee agreed to pay a $950.00 invoice, from Midwest Maintenance for culvert drainage pipe at Fireman's Park, out of ARPA funds.
- ~~The ARPA Committee has decided to disband.~~

Juan Bradford gave a summary of the estimates for the drainage repair, playground equipment, fitness trail, and exercise equipment for adults at Fireman's Park. These improvements are included in Resolution 2023-25.

E. DEPARTMENT REPORTS: BUILDING DEPARTMENT, FIRE DEPARTMENT, ORDINANCE OFFICER REPORT, PARKS COMMISSION MINUTES, SHERIFF'S REPORT

It was moved by Treasurer Lewis supported by Trustee McGill, that the Superior Township Board receive all reports.

The motion carried by unanimous vote.

9. COMMUNICATIONS

A. Letters Regarding Rezoning at 3900 Dixboro Rd.

It was moved by Treasurer Lewis supported by Trustee McGill, to receive letters.

The motion carried by unanimous vote.

The following are the communications that were received at the table.

- Due to the volume of communications received they are placed at the end of these minutes.

10. UNFINISHED BUSINESS

A. MASTER PLAN UPDATE – SUPERVISOR SCHWARTZ

Nothing to report currently.

B. SET DATE FOR SPECIAL MEETING TO EVALUATE CONTINUING CONTRACTS WITH TAZ AND OHM AND DISCUSS ROCK PROPERTY PROGRAMMING

There was verbal agreement by the Board to meet in early May.

C. STAMFORD ROAD WATER MAIN REPLACEMENT – RICKEY HARDING

This item was discussed during New Business.

D. APPROVE MONTHLY PAY OF PARKS AND RECREATION TRUSTEES

It was moved by Trustee McGill supported by Trustee Secrest to approve a monthly stipend equal to Park Commission stipend to Trustees appointed as liaisons to standing committees/commissions.

The motion carried by unanimous vote.

11. NEW BUSINESS

A. RESOLUTION 2023-22, APPROVAL TO ENTER INTO A STREET-SIDE MAINTENANCE AGREEMENT WITH MR. BUTLER FOR THE OAKBROOK AND WASHINGTON SQUARE SUBDIVISION COMMON AREAS

The following resolution was moved by Treasurer Lewis supported by Trustee McGill.

CHARTER TOWNSHIP OF SUPERIOR
WASHTENAW COUNTY, MICHIGAN
APRIL 17, 2023
RESOLUTION 2023-22

APPROVAL TO ENTER INTO A STREET-SIDE MAINTENANCE AGREEMENT WITH MR. BUTLER FOR THE OAKBROOK AND WASHINGTON SQUARE SUBDIVISION COMMON AREAS

WHEREAS, the Charter Township of Superior is a Michigan municipal corporation that provides public services to residents of the Township; and

WHEREAS, a Special Assessment District was created to provide funding for street-side maintenance in the Oakbrook and Washington Square subdivisions located in the Township, which includes cutting the grass and other maintenance of the common areas; and

WHEREAS, the Township Board has the responsibility to approve, execute and administer agreements to provide for such street-side maintenance; and

WHEREAS, Mr. Robert Lee Butler has worked as an independent contractor for the Township for many years; and

WHEREAS, the Township has been extremely satisfied with the performance of Mr. Butler.

NOW, THEREFORE BE IT RESOLVED, that the Charter Township of Superior Board of Trustees approves the agreement for 2023 with Mr. Robert Lee Butler for side-street

maintenance in an amount not to exceed $24,700.00 which is approximately 5% more than 2022 ($23,517.00) and authorizes the Township Supervisor to sign the Agreement, and that the cost of this agreement is to be taken from the Side Street Maintenance Fund, G.L. Account No. 220.

CERTIFICATION STATEMENT

I, Lynette Findley, the duly qualified Clerk of the Charter Township of Superior, Washtenaw County, Michigan, do hereby certify that the foregoing is a true and correct copy of a resolution adopted at a regular meeting of the Charter Township of Superior Board held on April 17, 2023, and that public notices of said meeting were given pursuant to Act No. 267, Public Acts of Michigan, 1976, as amended.

Lynette Findley, Township Clerk

4/17/2023
Date Certified

Roll Call:

Ayes: Trustee Lindke
Trustee Secrest
Trustee McGill
Treasurer Lewis
Trustee Caviston
Supervisor Schwartz
Nays: None
Absent: Clerk Findley

The resolution carried by unanimous vote.

B. <u>RESOLUTION 2023-23,</u> <u>RESOLUTION TO APPROVE AGREEMENT BETWEEN THE CHARTER TOWNSHIP OF SUPERIOR AND THE WASHTENAW COUNTY ROAD COMMISSION FOR 2023 ROAD IMPROVEMENTS</u>

Supervisor Schwartz explained his recommendation to approve numbers 6, 9, 10, and 13 of the resolution.

The following resolution was moved by Treasurer Lewis supported by Trustee McGill.

CHARTER TOWNSHIP OF SUPERIOR
WASHTENAW COUNTY, MICHIGAN
APRIL 17, 2023
RESOLUTION 2023-23

RESOLUTION TO APPROVE AGREEMENT BETWEEN THE CHARTER TOWNSHIP OF SUPERIOR AND THE WASHTENAW COUNTY ROAD COMMISSION FOR 2023 ROAD IMPROVEMENTS

WHEREAS, the parties of the first part desire that certain improvements be made upon the local roads in the Township of Superior; and,

WHEREAS, proper authority is provided to the parties of the agreement under the provisions in Act 51 of Public Acts of 1951 as amended; and,

WHEREAS, the parties of the second part will accomplish the improvements as specified herein, all in accordance with the standards of the parties of the second part; and,

WHEREAS, the parties of the first part shall pay WCRC for the actual project costs incurred for the project; and,

WHEREAS, the WCRC will submit an invoice to the Township on July 1, 2023, for 50% of the estimated project costs. Following project completion and final accounting of the project costs, WCRC will submit the final invoice for the actual remaining unpaid costs. The final invoice shall provide supporting details and information, which reasonably identifies the actual project costs incurred by WCRC. The Township described herein agrees to remit payment within 30 days from receipt of WCRC invoices.

1. **Gotfredson Road, Warren Road to M-153:**

Work to include drainage improvements, forestry, heavy brushing, culvert installation, shaping the existing surface, and the application of 8" (C.I.P.) of 23a limestone (approximately 5,900 tons) with associated dust control and project restoration.

Estimated project cost: $267,900.00.

2. **Joy Road, Tower Road to Curtis Road:**

Work to include drainage improvements, forestry, heavy brushing, shaping the existing surface, the application of 6" (C.I.P) of 23a limestone (approximately 3,700 tons) with associated dust control and project restoration. This is a proposed Township share project with Salem Township. Estimated total project cost: $145,000.00 Estimated project cost to Superior Township: $72,500.00.

3. **Joy Road, Vorhies Road to Dixboro Road:**

Work to include drainage improvements, forestry, heavy brushing, shaping the existing surface, the application of 6" (C.I.P) of 23a limestone (approximately 3,100 tons) with

associated dust control and project restoration. This is a proposed Township share project with Salem Township. Estimated total project cost: $149,000.00 Estimated project cost to Superior Township: $74,500.00.

4. **Joy Road, Vorhies Road to Tower Road:**

Work to include drainage improvements, forestry, heavy brushing, culvert replacement, shaping the existing surface, the application of 6" (C.I.P) of 23a limestone (approximately 4,000 tons) with associated dust control and project restoration. This is a proposed Township share project with Salem Township.

Estimated total project cost: $219,000.00 Estimated project cost to Superior Township: $109,500.00

5. **Leforge Road, Vreeland Road to Geddes Road:**

Work to include drainage improvements, forestry, heavy brushing, culvert installation, shaping the existing surface, and the application of 8" (C.I.P.) of 23a limestone (approximately 4,300 tons) with associated dust control and project restoration.

Estimated project cost: $185,600.00.

6. **Township-Wide Limestone:**

Work to include shaping the existing surface, and the spot application (C.I.P) of 23a limestone (approximately 2,500 tons) with associated dust control and project restoration on various roads, locations as determined by mutual agreement between the District Foreman and Township Supervisor.

Estimated project cost: $ 64,000.00.

7. **Warren Road, Gotfredson Road to Berry Road:**

Work to include drainage improvements, forestry, heavy brushing, culvert installation, shaping the existing surface, and the application of 6" (C.I.P.) of 23a limestone (approximately 3,500 tons) with associated dust control and project restoration.

Estimated project cost: $215,500.00.

8. **Overbrook Drive, Dixboro Road to Rolling Ridge Court:**

Work to include drainage improvements, milling the existing pavement, the placement of 2.5" HMA resurfacing and associated project restoration.

Estimated project cost: $137,000.00.

9. **Stamford Road, Barrington Drive to MacArthur Boulevard:**

Work to include milling the existing pavement, the placement of 2" HMA resurfacing and associated project restoration.

Estimated project cost: $187,000.00.

10. **Stephens Drive, South Kingston Court to Stamford Road:**

Work to include milling the existing pavement, the placement of 2" HMA resurfacing and associated project restoration.

Estimated project cost: $58,000.00.

11. **Warren Road, Curtis Road to End of Pavement:**

Work to include drainage improvements, heavy brushing, crush & shape the existing pavement, the placement of 3.5" HMA resurfacing and associated project restoration.

Estimated project cost: $361,000.00.

12. **Creekside Court, Overbrook Drive to End of Road:**

Work to include drainage improvements, mill the existing pavement, the placement of 3" HMA resurfacing and associated project restoration.

Estimated project cost: $103,300.00.

13. **Harris Road Approach onto Geddes Road:**

Work to include drainage improvements, mill the existing pavement, the placement of 3" HMA resurfacing and associated project restoration.

Estimated project cost: $21,000.00.

AGREEMENT
SUMMARY

2023 LOCAL ROAD PROGRAM

Gotfredson Road, Warren Road to M-153	$ 267,900.00
Joy Road, Tower Road to Curtis Road	$ 72,500.00
Joy Road, Vorhies Road to Dixboro Road	$ 74,500.00
Joy Road, Vorhies Road to Tower Road	$ 109,500.00
LeForge Road, Vreeland Road to Geddes Road	$ 185,600.00
Township-Wide 23A Limestone	$ 64,000.00
Warren Road, Gotfredson Road to Berry Road	$ 215,500.00
Overbook Drive, Dixboro Road to Rolling Ridge Court	$ 137,000.00
Stamford Road, Barrington Drive to MacArthur Blvd	$ 187,000.00
Stephens Drive, South Kingston Court to Stamford Road	$ 58,000.00
Warren Road, Curtis Road to End of Pavement	$ 361,000.00
Creekside Court, Overbrook Drive to End of Road	$ 103,300.00
Harris Road Approach onto Geddes Road	$ 21,000.00
Subtotal	$1,856,800.00

Less WCRC 2023 Local Matching Funds $94,914.00

ESTIMATED AMOUNT TO BE PAID BY SUPERIOR TOWNSHIP
UNDER THIS AGREEMENT DURING 2023: **$ 1,761,886.00.**

WHEREAS, the estimated amount to be paid by Charter Township of Superior under this agreement during 2023 is $1,761,886.00. **The total amount is $1,856,800.00 with a WCRC 2022 Local Matching Funds of $94,914.00.**

NOW THEREFORE, BE IT RESOLVED that the Charter Township of Superior Board of Trustees hereby authorizes the payment of $1,761,886.00 and approves the Washtenaw County Road Commission to complete road improvement projects in 2023.

Roll Call:

Ayes: Supervisor Schwartz
Trustee McGill
Trustee Caviston
Treasurer Lewis
Trustee Lindke
Trustee Secrest
Nays: None
Absent: Clerk Findley

The resolution carried by unanimous vote.

Resolution 2023-23, A Resolution to Approve Agreement Between the Charter Township of Superior and the Washtenaw County Road Commission for 2023 Road Improvements will need to be corrected at the May 15, 2023, meeting to reflect that only the above highlighted items (#6, #9, #10 and #13) were approved. After the WCRC 2022 Local Matching Funds of $94,914.00 the total cost to the Township will be $244,914.00.

C. RESOLUTION 2023-24 RESOLUTION TO APPROVE FIRST AMENDMENT TO PUMP STATION EASEMENT FOR COUNTY PARKS

Supervisor Schwartz gave a recap of the events leading to the need for a new easement.
Trustee Lindke stated the Resolution gives a date of November 10, 2023, and she does not feel the project would be done by then.
Trustee Lindke and Trustee McGill asked that the resolution be tabled and corrected to state the Township has one year to complete the pump station.

It was moved by Trustee McGill supported by Trustee Lindke to table the resolution until the May 15, 2023, regular Board meeting.

CHARTER TOWNSHIP OF SUPERIOR
WASHTENAW COUNTY, MICHIGAN
APRIL 17, 2023
RESOLUTION 2023-24

RESOLUTION TO APPROVE FIRST AMENDMENT TO PUMP STATION EASEMENT FOR COUNTY PARKS

WHEREAS, this is a First Amendment to Pump Station Easement between Washtenaw County, a Michigan municipal corporation, by the Washtenaw County Parks and Recreation Commission, P.O. Box 8645, 2230 Platt Rd., Ann Arbor, MI 48107-8645 ("Grantor"), and the Charter Township of Superior, 3040 North Prospect, Ypsilanti, MI 48198, ("Grantee"); and,

WHEREAS, Grantor granted a Pump Station Easement to Grantee dated November 10,2020, which Easement was recorded at Lib er 5388, page 929 Washtenaw County Records on November 20, 2020, regarding the property commonly known as 325 Clark Road, Ypsilanti, Michigan (Tax Identification Number J-10-33-400-029); and,

WHEREAS, pursuant to the Easement, all work was to be completed no later than November 10, 2021; and,

WHEREAS, the pump station work has not been completed and the undersigned parties wish to extend the temporary construction easement portion of the Pump Station Easement.

WHEREAS, all work shall be completed no later than November 30, 2023, at which time the temporary construction easement shall cease and any and all equipment and materials shall be removed, and the Property fully restored.

NOW THEREFORE, BE IT RESOLVED, the Charter Township of Superior Board of Trustees agrees to, except as modified therein, the terms and conditions of the original Pump Station Easement.

The resolution was tabled.

D. <u>RESOLUTION 2023-25 RESOLUTION TO COMMIT REMAINING AMERICAN RESCUE PLAN ACT (ARPA) FUNDS TO THE PROPOSED COMMUNITY CENTER</u>

It was moved by Trustee McGill supported by Treasurer Lewis for a friendly amendment to add the $950.00 invoice from Midwest Maintenance.

The motion carried by unanimous vote.

The following resolution was moved by Treasurer Lewis supported by Trustee Caviston.

CHARTER TOWNSHIP OF SUPERIOR
WASHTENAW COUNTY, MICHIGAN
APRIL 17, 2023
RESOLUTION 2023-25

RESOLUTION TO COMMIT REMAINING AMERICAN RESCUE PLAN ACT (ARPA) FUNDS TO THE PROPOSED COMMUNITY CENTER

WHEREAS, the American Rescue Plan Act (ARPA) was passed to help communities begin to recover from the negative effects of the pandemic, particularly communities where historic systemic health and economic disparities have been exacerbated by the pandemic; and,

WHEREAS, one of the provisions of the ARPA eligible uses was "to respond to the public health emergency and its negative economic impacts"; and,

WHEREAS, the Charter Township of Superior was allocated $1,501,402.52 in ARPA funds to support the communities hardest hit by the COVID-19 crisis; and,

WHEREAS, the Township held various working sessions which included public participation and discussion about the needs of our communities; and,

WHEREAS, the Board, through Resolution #2021-80, committed all of its ARPA funds to projects located within the Township's designated Qualified Census Tract (QCT); and,

WHEREAS, a QCT is defined as an area in which "50% or more of the households are income eligible and the population of all census tracts that satisfy this criterion does not exceed 20% of the total population of the respective area"; and,

WHEREAS, among the neighborhoods in the Township QCT are: Sycamore Meadows, Washington Square, Danbury Park Manor, Arbor Woods, Harvest Lane, and West Ridge Mobile Home Park; and,

WHEREAS, COVID-19 has disproportionately impacted low-income families and communities of color and has exacerbated systemic health and economic inequalities; and,

WHEREAS, the Board, through several resolutions has committed $484,500.00 in ARPA funding to the following programs:

The Mighty Oaks Project CLR Academy: $68,000.00
There and Back (contract for transportation for the Mighty Oaks Project): $8,500.00

Youth Area Arts Alliance: $68,000.00
There and Back (contract for transportation for the Mighty Oaks Project): $12,000.00
Willow Run Acres: $190,000.00
Superior Township Parks and Recreation engineering work for Fireman's Park drainage: $24,500.00
Washtenaw Intermediate School District Success by 6 Project: $50,000.00
Superior Township Parks and Recreation budget for Fireman's Park playground equipment: $50,000.00
Remaining commitment to Mighty Oaks Project and Youth Area Arts Alliance: $13,500.00

WHEREAS, the ARPA Funds Committee is recommending payment in the amount of $950.00 to Midwest Maintenance Inc. for the cleaning of the drainage pipe at Fireman's Park in preparation for drainage improvements; and,

WHEREAS, the ARPA Funds Committee is recommending the approval of the requested Capital improvements at Fireman's Park in the amount of $218,000.00; and,

WHEREAS, with the approval of the Capital Improvements project at Fireman's Park, the remaining balance of ARPA funds will be $797,952.52.00; and,

WHEREAS, the ARPA Funds Committee has recommended that the remaining ARPA funds be committed to the development of the Community Center; and,

WHEREAS, ARPA funds must be allocated by 2024 and spent by 2026.

NOW THEREFORE BE IT RESOLVED that the Charter Township of Superior will commit $797,952.52, the remaining balance of the ARPA funding, to the development of the Community Center in the Charter Township of Superior.

CERTIFICATION STATEMENT

I, Lynette Findley, the duly qualified Clerk of the Charter Township of Superior, Washtenaw County, Michigan, do hereby certify that the foregoing is a true and correct copy of a resolution adopted at a regular meeting of the Charter Township of Superior Board held on April 17, 2023, and that public notices of said meeting were given pursuant to Act No. 267, Public Acts of Michigan, 1976, as amended.

Lynette Findley, Township Clerk

4/17/2023
Date Certified

Roll Call:

Ayes: Treasurer Lewis
Trustee Secrest
Trustee McGill
Trustee Caviston
Trustee Lindke
Supervisor Schwartz
Nays: None
Absent: Clerk Findley

The resolution carried by unanimous vote.

E. RESOLUTION 2023-26, A RESOLUTION TO URGE PRESIDENT BIDEN AND THE CONGRESS OF THE UNITED STATES TO NORMALIZE TRADE AND DIPLOMATIC RELATIONS WITH THE REPUBLIC OF CUBA BY DISSOLVING THE CURRENT U.S. TRADE EMBARGO, REMOVING CUBA FROM THE STATE SPONORS OF TERRORISM LIST AND OTHER BARRIERS

Supervisor Schwartz explained the resolution.

The following resolution was moved by Trustee McGill supported by Trustee Secrest.

CHARTER TOWNSHIP OF SUPERIOR
WASHTENAW COUNTY, MICHIGAN
APRIL 17, 2023
RESOLUTION 2023-26

A RESOLUTION TO URGE PRESIDENT BIDEN AND THE CONGRESS OF THE UNITED STATES TO NORMALIZE TRADE AND DIPLOMATIC RELATIONS WITH THE REPUBLIC OF CUBA BY DISSOLVING THE CURRENT U.S. TRADE EMBARGO, REMOVING CUBA FROM THE STATE SPONORS OF TERRORISM LIST AND OTHER BARRIERS

WHEREAS, The United States established diplomatic relations with the Republic of Cuba in 1902, opening the first U.S. Embassy in Havana in 1923; and,

WHEREAS, On February 3, 1962, The Kennedy administration imposed the U.S. embargo on Cuba; and,

WHEREAS, the U.S. government has placed significant restrictions and prohibitions on American-Cuban relationships, particularly in trade, travel, and financial transactions; and,

WHEREAS, for more than six decades, the United States has maintained a strict embargo against the Republic of Cuba through a comprehensive set of economic sanctions levied through various laws, regulations, and presidential orders; and,

WHEREAS, The Republic of Cuba is currently home to more than 11 million people and the nation's proximity to the United States makes Cuba a logical partner for expanded U.S. trade and export of agricultural products; and,

WHEREAS, the Republic of Cuba imported $2 billion in agricultural products to feed the Cuban people in 2021, but only $157 million worth of agricultural products were imported from the United States; and,

WHEREAS, in 2022, the U.S. International Trade Commission estimated that American exports to Cuba could rise to $1.8 billion annually if the embargo is dissolved, and improved access to U.S. producers could provide Cubans with more affordable food options; and,

WHEREAS, after over 50 years of severed relations, diplomatic ties between the United States and Cuba were resumed and were officially established on July 20, 2015; and,

WHEREAS, during the Trump Administration, the United States enacted 243 policy actions that negatively impacted Cuba, including placing Cuba on the State Sponsors of Terrorism (SSOT) list, thus reversing the Obama/Biden era policy of positive, diplomatic, engagement with Cuba; and,

WHEREAS, the consequences of the embargo continue to inflict daily hardships and deprivations on the Cuban people, contributing to shortages of basic necessities like food and medicine, and severely restricting international financial trade opportunities. The embargo prevents Cuba from obtaining vital medical equipment and supplies, and impeded humanitarian aid responses during catastrophic events like Hurricane Ian, which devastated both Florida and Cuba, thus harming the Cuban people who President Biden's administration communicates a desire to support; and WHEREAS, on June 23, 2021, United Nations General Assembly voted to condemn the United States' embargo against Cuba, for the 29th time, with 184 of 191 nations decisively voting in favor; and,

WHEREAS, Cuba's arbitrary designation on the SSOT list has subjected them to further sanctions and international financial restrictions that limit the nation's ability to carry out critical financial transactions, including those needed to combat the Covid-19 pandemic and improve the economy; and,

WHEREAS, in 2021, 117 members of the U.S. Congress called for the removal of Cuba from the SSOT list, noting in a letter that,"... policy engagement with Cuba serves U.S. interests and those of the Cuban people"; and,

WHEREAS, Michigan's agricultural sector, thus the agriculture industry in Washtenaw County, could benefit from greater access to Cuban consumers, and access to the Cuban market could mean new opportunities for Michigan growers to export dry beans, dairy products, fresh fruit, and other in-demand commodities and food products to Cuban consumers; and,

WHEREAS, ending the more than half-century long trade embargo against the Republic of Cuba by relaxing the regulations and prohibitions on American exports and financial services to Cuba has the potential to boost the economies of both nations and could allow American farmers, ranchers, and food companies to efficiently contribute to the food security needs of the Cuban citizenry; and,

WHEREAS, to that end, on February 8, 2023, Washtenaw County hosted the Cuban Ambassador to the United States, H.E. Lianys Torres Rivera; and,

WHEREAS, Ambassador Torres Rivera and her retinue was greeted warmly by Washtenaw County officials and held discussions with county residents. The visit resulted in a positive cultural exchange and set the foundation for future engagement.

NOW THEREFORE BE IT RESOLVED, the Charter Township of Superior Board urges the Administration of President Biden and the United States Congress to dissolve the embargo and trade barriers against Cuba; and

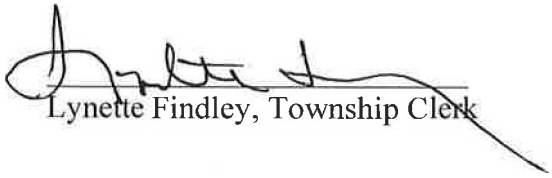
BE IT FURTHER RESOLVED, the Charter Township of Superior Board urges the Biden Administration to remove Cuba from the U.S.'s State Sponsors of Terrorism list; and

BE IT FURTHER RESOLVED, the Charter Township of Superior Board urges the Biden Administration and Congress to expand diplomatic relations between the American and Cuban governments, allowing for freer travel, partnerships, and trade with the Republic of Cuba; and

BE IT FURTHER RESOLVED, no later than 30-days after the passage of this resolution, the Charter Township of Superior Clerk's office shall transmit copies of this resolution to the President and Vice-President of the United States, to the Speaker of the House of the Representatives, to the Majority Leader of the United States Senate, to each U.S. Senator and Representative from the State of Michigan currently serving in the Congress of the United States.

CERTIFICATION STATEMENT

I, Lynette Findley, the duly qualified Clerk of the Charter Township of Superior, Washtenaw County, Michigan, do hereby certify that the foregoing is a true and correct copy of a resolution adopted at a regular meeting of the Charter Township of Superior Board held on April 17, 2023, and that public notices of said meeting were given pursuant to Act No. 267, Public Acts of Michigan, 1976, as amended.



Lynette Findley, Township Clerk

4/17/2023
Date Certified

The resolution carried by unanimous vote.

F. RESOLUTION 2023-27 RESOLUTION TO DECLARE APRIL 28, 2023, WORKERS MEMORIAL DAY IN THE CHARTER TOWNSHIP OF SUPERIOR

Supervisor Schwartz explained the resolution.

The following resolution was moved by Trustee Secrest supported by Trustee McGill.

CHARTER TOWNSHIP OF SUPERIOR
WASHTENAW COUNTY, MICHIGAN
APRIL 17, 2023
RESOLUTION 2023-27

RESOLUTION TO DECLARE APRIL 28, 2023, WORKERS MEMORIAL DAY IN THE CHARTER TOWNSHIP OF SUPERIOR

WHEREAS, every year on April 28, communities and worksites around the world honor friends, family members, and colleagues who have been killed or injured on the job; and

WHEREAS, in 2021, The Federal Bureau of Labor Statistics estimated that 5,190 workers were killed by traumatic injuries on the job. On average, nearly 100 workers died every week, at roughly 14 workplace deaths a day; and,

WHEREAS, in 2021, 1401 workers were lost through fatal workplace accidents in Michigan; and,

WHEREAS, it is appropriate to honor the memory of the courageous and dedicated members of Michigan's labor force who have been injured or disabled or have died as a result of workplace accidents; and,

WHEREAS, we remember those who have died in workplace catastrophes, suffered occupational-related diseases, or have been injured due to dangerous conditions; and,

WHEREAS, recognition of the integrity of Michigan's workforce and its achievements on behalf of the economic growth of our state is necessary; and,

WHEREAS, the Charter Township of Superior Board wishes to pay tribute to the workers who have died or been injured or disabled in workplace accidents. We honor the contributions of Michigan's workforce and call for increased workplace safety; and,

WHEREAS, the Charter Township of Superior renews our efforts to seek stronger workplace safety and health protections, better standards, and enforcement, and fair and just compensation; and by rededicating ourselves to improving safety and health in every city workplace.

NOW THEREFORE IT BE RESOLVED THAT, the Charter Township of Superior Board do hereby proclaim April 28, 2023: Workers Memorial Day, in the Charter Township of Superior, Michigan, and urge all citizens to recognize and honor the contributions of Michigan's workforce and call for increased workplace safety standards.

CERTIFICATION STATEMENT

I, Lynette Findley, the duly qualified Clerk of the Charter Township of Superior, Washtenaw County, Michigan, do hereby certify that the foregoing is a true and correct copy of a resolution adopted at a regular meeting of the Charter Township of Superior Board held on April 17, 2023, and that public notices of said meeting were given pursuant to Act No. 267, Public Acts of Michigan, 1976, as amended.

Lynette Findley, Township Clerk

4/17/2023
Date Certified

The resolution carried by unanimous vote.

G. RESOLUTION 2023-28 RESOLUTION TO REPLACE THE STAMFORD ROAD WATER MAIN FROM MACARTHUR BLVD TO NORFOLK AVE.

Mary Burton and Ricky Harding gave a brief overview of the work needed and their recommendation.

The following resolution was moved by Treasurer Lewis supported by Trustee McGill.

CHARTER TOWNSHIP OF SUPERIOR
WASHTENAW COUNTY, MICHIGAN
APRIL 17, 2023
RESOLUTION 2023-28

RESOLUTION TO REPLACE THE STAMFORD ROAD WATER MAIN FROM MACARTHUR BLVD TO NORFOLK AVE.

WHEREAS, the Stamford Rd. water main from MacArthur Blvd. to Norfolk Ave. needs replacement. The main is volatile and has become costly with emergency repairs being needed three times in 2022; and,

WHEREAS, the position of the main needs to be moved to the correct distance away from homes where it is within 6 ft. of the front porch or driveway; and,

WHEREAS, the replacement costs will be $397,855.00 which includes 1,283 l.f. of 16" cast iron pipe with 1,282 l.f. of 8" HDPE including all needed hydrants, valves, water services, reconnection, and restoration.

WHEREAS, AAA Underground and Grading has worked on this watermain in the past as D&D Water and Sewer.

NOW THEREFORE, BE IT RESOLVED, the Charter Township of Superior Board approves the bid for $397,855.00 from AAA Underground and Grading to replace the Stamford water main from MacArthur Blvd. to Norfolk Ave. to be paid for by the Utilities Fund.

CERTIFICATION STATEMENT

I, Lynette Findley, the duly qualified Clerk of the Charter Township of Superior, Washtenaw County, Michigan, do hereby certify that the foregoing is a true and correct copy of a resolution adopted at a regular meeting of the Charter Township of Superior Board held on April 17, 2023, and that public notices of said meeting were given pursuant to Act No. 267, Public Acts of Michigan, 1976, as amended.

Lynette Findley, Township Clerk

4/17/2023
Date Certified

Roll Call:

Ayes: Supervisor Schwartz
Trustee McGill
Trustee Caviston
Treasurer Lewis

Trustee Lindke
Trustee Secrest
Nays: None
Absent: Clerk Findley

The resolution carried by unanimous vote.

H. MOTION TO ACCEPT TRANSIENT AND AMUSMENT ENTERPRISES ACTIVITY PERMIT APPLICATION-DIXBORO FARMERS' MARKET

It was moved by Treasurer Lewis supported by Trustee Lindke to accept the Transient and Amusement Enterprises Activity Permit Application.

The motion carried by unanimous vote.

12. BILLS for PAYMENT and RECORD of DISBURSEMENTS

It was moved by Trustee Caviston supported by Trustee Lindke, to receive bills for payment and record of disbursements.

The motion carried by unanimous vote.

13. PLEAS and PETITIONS

- Treasurer Lewis thanked Juan Bradford for the Parks and Recreation Department's help with delivering donations to the Hope Clinic.
- Juan Bradford reported that the paperwork for the Trust Fund Grant for the Cherry Hill Greenway has been submitted and he received word that it is moving to the next phase.
- The Board recognized the hard work of Jack Smiley on the Grant for the Greenway.
- Kelly Goolsby recognized Juan Bradford for all the work being done at Fireman's Park. She asked if there would be a crosswalk at Danbury Park and stated visibility of the new library from MacArthur is poor due to overgrowth.
- Supervisor Schwartz stated there would not be a crosswalk in that location, and that the Township would investigate clearing up some of the overgrowth.
- Irma Golden thanked the Board for marking the locations sidewalk repair is required, and reported she would be sending an email with the details of a location on Glendale that was missed. She asked if Supervisor Schwartz would be sending a letter to residents who need to make sidewalk repairs.

- Supervisor Schwartz stated he would be sending a letter and that it would probably go out in May. He added that it would include details on a possible payment plan for residents.
- Brenda Baker asked that the letter include what criteria are used in determining if something needs repair.
- Trustee Lindke asked Supervisor Schwartz if he had a retirement date set.
- Supervisor Schwartz stated he does not have an exact date; he wants to see how long his recovery from surgery will take and he is concerned about the number of on-going projects being a burden to a new person.
- Trustee McGill stated her appreciation to Ricky Harding and Mary Burton for all of their hard work.
- Fred Lucas, Township Attorney, asked for a motion to grant approval to Ron Deneweth to send a termination letter to LaSalle.

It was moved by Trustee McGill supported by Treasurer Lewis to approve sending a termination letter to LaSalle.

The motion carried by unanimous vote.

- Trustee McGill asked about the status of the pump station shaft maintenance.
- Fred Lucas stated he would speak with Ron Deneweth about the motion from the March 20, 2023, meeting in which it was approved pending Mr. Deneweth's review.

14. ADJOURNMENT

It was moved by Trustee Lindke supported by Trustee Secrest, that the meeting be adjourned. The motion carried and the meeting adjourned at 8:50 p.m.

Respectfully submitted,

Lynette Findley, Clerk

Kenneth Schwartz, Supervisor

From: Cindy Abgarian <cgills@comcast.net>
Sent: Thursday, April 13, 2023 2:04 PM
To: Lynette Findley <lynettefindley@superior-twp.org>
Subject: Garrett's Space

Dear Board of Trustees,

As a resident of Superior Township, we are writing to oppose the rezoning of 3900 N. Dixboro for a residential treatment center for anxious, depressed and suicidal adults.

While we broadly support alternative treatment for mental health care, this particular facility at this specific site is a liability to the adjacent neighborhood and the entire township.

In order to skirt the zoning ordinance language, we have learned this facility will not be licensed. This is unlicensed transient housing.

- Lack of licensure and lack of specificity in the zoning application gives Garrett's Space wide latitude to do what they please. For example, despite Garrett's Space's stated mission to treat adults age 18 to 28; this is not including in the zoning application and will give them the ability to house any adult there. Similarly, Garrett's Space directors have expressed the desire to house those immediately released from the hospital following a suicide attempt. Although they no longer propose this on their website, there is nothing in the zoning language that would stop this usage. Length of stay, number of patients, staffing and usage are in a constant state of flux.
- Zoning goes with the land. What will this facility become if Garrett's Space fails?

This lack of licensure is a blank check to do as they please; this is an unregulated facility.

Additionally, while Garrett's Space offers many statistics, they do not provide any peer reviewed research to prove the facility will accomplish its goals. They provide only anecdotal evidence. They pride themselves on being the first of its kind anywhere. This is an experiment.

- They say they will attempt to screen out those with imminently suicidal, those with psychosis or mania or who represent a danger to others. There are multiple studies that show psychological misdiagnosis is a common occurrence. Many psychological illnesses change presentation with time. There is no way to prevent some degree of misdiagnosis.
- The organization has no history of in-patient treatment. Most of their therapy is online group therapy.
- There are no standards of care for a facility like this.

As nearby residents, we have many security concerns; both for our own safety and those of patients at the facility.

- The directors of Garrett's Space have not publicly addressed any security issues.
- There will only be 2 employees overnight securing 75 acres and 20 mood disordered, suicidal people in a coed facility. How will they keep the people there secure from intruders and from one another and from themselves?
- The site lacks secure boundaries. Dennis Serras, deceased owner of the property frequently walked from his home at 3900 Dixboro to neighboring homes across the creek. There is nothing to stop the patients from doing the same thing. For most of the year, the creek is easily passable, and the woods are dotted with deer trails that lead to other adjoining properties.
- The directors of Garrett Space frequently use the Ozone House and Dawn Farms as analogous examples of residential treatment facility. These facilities are licensed and follow state protocol; however, online reviews report patients leave and go missing with some regularity. As a facility housing adults, patients can come and go on their own volition.

- There is no stated plan for dealing with substance abuse or weapons. Will this be a sober living facility? The directors only offer the assurance that it "these are good kids."

Garrett's Space is underfunded.

- The founders say they need another $6,000,000 for a full build out.
- The founders said, a year ago, they anticipate up to $2,000,000 annually to operate. Inflation has likely increased this number greatly.
- As an unlicensed and nonmedical facility, they will be unlikely to use health insurance or Medicaid to fund operating costs. Who are they going to serve? How long will they be able to maintain a sliding scale? This is an expensive 24-7 operation.

Density of Use

- They do not say how many day users they anticipate in zoning application. They are going to need to see a lot of patients to cover costs. They say they will have 30 users at a time but do not say if day users will be coming and going throughout the day. They also anticipate family visits.
- This is a transient use of the property. Residential housing adds stability to the neighborhood. This will have to opposite effect.
- 3900 N. Dixboro has been on and off the market for almost a decade. No developer has figured out a way to make a residential redevelopment pencil out. Substantial wetlands, slopes and woodlands limit developable land.
- According to the zoning application, there is no conservation easement shown on any map.

Garrett's Space states that the facility will not be visible to nearby residents. This is a fallacy. The house and barn are readily visible now to many adjacent neighbors and the new facility is unlikely to be shielded from view.

- Noise and light pollution are real considerations. Any nighttime activities will shed light that will be visible to neighboring houses. Based on the location of housing, sound travels now and will be a real concern with a higher density of use.
- The proposed 11,000 square foot facility does not look residential. It looks like an institutional group home.

Rezoning this property sets a terrible precedent for the township. There are several large lot estates and big farms in rural areas of the township.

- Ignoring the Master Plan in order to allow this will have a snowball effect and we can expect other developers, quasi -medical service facilities and others to see this area ripe for redevelopment.
- There are other locations for a facility like this that do not abut a residential neighborhood.

The neighborhood adjoining 3900 N. Dixboro is an active, vibrant neighborhood. We have annual get togethers, Halloween hayrides and an active email group. We have a long history of helping one another. As taxpayers and voters, not only have we put our faith in our elected officials honoring our Master Plan, but we have also been paying into a legal fund to defend it. This project is not in keeping with the Master Plan. This unlicensed and untested facility is not suitable for a residential area. We opposed this rezoning and count on our elected official to enforce our Master Plan and truly keep our township Superior.

Sincerely,

_____

Name
Alan and Cynthia Abgarian
%420 Meadowcrest Dr
Ann Arbor, Mi 48105
Superior Twp
7343895420

To Superior Township Planning Commission and Board of Trustees,

I am here to write my utmost disappointment as a citizen of the Superior Township, facing a significant change at 3900 N Dixboro, that does not belong to our promised Master Plan. I will not be disclosing my name or my address due to fear of threats as this matter is now widely published in the media.

This project would have never come to fruition if the Township have indicated that the rezoning is not allowed per our Master Plan when Mr. and Mrs. Halpert first approached the real estate. This property has been under contract since June 2022. I cannot help but suspect uplifting promises the Superior Township has made to the Halpert's while your current residents near the property was **minimally** taken into consideration. This is called **preferential** treatment. This is **political.** And unfortunately, **this is the opposite of democracy** --- by the people, for the people. This proposal should have been disclosed many months earlier so your current residents were able to make informed decision, prepared in advance, and subsequently vote for yes or no to rezoning. Instead, the Township has caused havoc to the neighborhood --- the neighborhood in which many families cannot sleep at night due to heightened anxiety.

It has been a painful process to become part of a media circus, get our characters judged by strangers, and called selfish or by a derogatory term NIMBY's. Let me clarify, **we are essentially all NIMBY's**. When we purchase a **permanent home**, we look for a certain location and criteria that is most optimal for our personal lives based on our budgets. For us, our objective was to find a rural, non-commercialized community. For us, this property is the biggest investment in our lives after sacrificing countless hours and overtime to build our savings. We trusted in the Township, so we can have a prosperous future as we grow old in the community. One of the research articles suggested this type of facility would decrease our property value by possibly 17%. That is a loss we will never be able to recover.

The founders of Garrett's Space reside in Burns Park of Ann Arbor. I cannot imagine that the residents of Burns Park would say yes to rezoning to bring in any type of transient housing, such as Garrett's Space. In fact, their neighborhood fought to pass a rezoning in 2008 from multiple-family to single-family housing to "eliminate the possibility of existing homes being torn down for larger commercial-style developments," which **at that time their zoning allowed.** According to Michigan Daily, "Opponents of the rezoning suggested that the plans were designed to keep out students... The biggest advocate of the rezoning, the Lower Burns Park Neighborhood Association wanted to eliminate this possibility and argued that more multi-family dwellings would threaten the character of the neighborhood." I strongly doubt that the majority of people would accept a mental health care facility behind their backyard without showing concerns. Even worse**, our Superior Township Master Plan does NOT allow this type of zoning changes**, yet we are still subjected to rezoning.

On our current Zoning Ordinance No. 174, Section 18.06, it describes that the Planning Commission shall identify and evaluate all factors relevant to the petition:

Section 18.06 Findings of Fact Required.

In reviewing any petition for a zoning amendment, the Planning Commission shall identify and evaluate all factors relevant to the petition. All findings of fact and conclusions shall be made a part of the public records of the meetings of the Planning Commission. The facts to be considered by the Planning Commission shall include, but shall not be limited to, the following:

1. Whether or not the requested zoning change is justified by a change in conditions since the original Ordinance was adopted, or by an error in the original Ordinance.

2. The precedents, and the possible effects of such precedents, that might result from approval or denial of the petition.

3. The capacity of Superior Township or other government agencies to provide any services, facilities, and/or programs that might be required if the petition were approved.

4. Effect of approval of the petition on the condition and/or value of property in Superior Township or in adjacent municipalities.

5. Relation of the petition to the Township's adopted Growth Management Plan, and of other government units where applicable.

A petition shall not be approved unless these and other facts are affirmatively resolved in terms of resource guardianship, public necessity, convenience, and safety, and the general welfare of Superior Township and of other civil divisions, where applicable.

For **the immediate residents around the 3900 N Dixboro property**, this zoning change is of a great importance compared to other residents in the Superior Township or Ann Arbor Township. It is uncomplicated and effortless for people outside of the close vicinity to support rezoning because it will NOT directly affect their lives. This zoning change, **a break in the Township's promise to their people**, will **affect our lives --- every, single, day.** At the same time, I want to remind all the Township communities that this rezoning could be a consequential change, as it sets precedents as noted under Section 18.06, number 2. In addition, I also want to remind you that we pay taxes, in which some portion goes to the Township's legal fund to defend the Master Plan. **Please protect this Master Plan as you sworn to us.**

Unfortunately, **money is power. Politics polarizes us.** I cannot help to think but this is all political and the Board of Trustees have made up their mind for rezoning **without** our input. I beg you please, to drop your bias; **disclose and resign to vote if you have any conflicts of**

interest such as established relationship with the Garrett's Space organization; drop your political affiliation and look at this from our perspective.

I thank you for your consideration in this serious matter.

Superior Township Board of Trustees and Planning Committee:

- Please note I will not be disclosing my name or address due to fear of threats. This matter is being followed by the media. I have been told that the Township will be accepting letters from residents close to the property without providing their name or address due to safety concerns

How can 3900 N. Dixboro be rezoned from A2 to a planned community district when only one entity will be going into the district and that is Garrett's Space? There are no provisions for any other "mixed uses," including "clustered" single-family residences. In fact, there will not be any single-family residences left on the property if the rezoning goes through because the area plan calls for turning the current residence into administrative offices. With no single-family homes on the property, it would not fit with the rural residential character of the surrounding neighborhood or the township's future growth plan for the sub-area.

The proposed use and development is not compatible with the growth management plan for rural districts. It is actually quite the opposite. This proposed plan and use represents high density use with adults frequently incoming/outgoing for inpatient overnight care, daily programming outpatient care, incoming/outgoing staff, etc. This high density usage and housing is not consistent with the very low density single family housing in this sub area of the township.

The Petition filed frequently refers to low density usage. The Zoning Plan defines Rural Districts as follows;

"The principal purpose of the Rural District designation is to focus on conservation of lands with sensitive environmental characteristics like woodland, wetland, wildlife habitat, and farmland. A range of agricultural uses and agricultural support services are permitted, **along with a limited range of very low-density single-family residential uses**. Gravel roads serve most of the land in these districts, and there are no plans to pave these roads. The land zoned within these districts generally conforms to the area designated as "agricultural lands, conservation or rural residential" or "rural residential" on Map 6-4, Future Land Use."

Their proposed "low density" usage does not conform to the definition specifically stated in the Zoning Plan of the Master Plan where it says, "**a limited range of very low density single-family residential uses**" is permitted in a rural district. The Future Land Use map further illustrates this. The proposed usage is high density in comparison to the Master Plan's defined uses in a rural district.

The Fair Housing Act is not applicable to this proposed usage provided in the petition plan. The individuals staying at the proposed facility are not residents. They are receiving treatment for their mental illnesses for short term stays of 2-4 weeks per the petition plan. Individuals will return to their permanent residence upon the completion of their treatment.

Is the Rezoning Petition for a planned community the most appropriate zoning request? Or is it just the most convenient for the petitioners? The proposed usage and development is not consistent with the definition of a planned community in a rural district. The facility vets and provides treatment for individuals diagnosed with specific medical diseases. Their website states that medical professionals such as nurses, social workers, psychiatrists, and their medical director will be providing care and treatment. A Medical Services rezoning petition request is most appropriate. This needs to be evaluated by the planning committee and the Petition should be revised accordingly.

The proposed facility is unlicensed, untested, unregulated, and minimally supervised. The Petitioner's website refers to this treatment facility as, "the first of its kind." They propose to jump from online meetings directly to a 24 hour inpatient treatment facility for individuals suffering from diagnosed mental diseases. What tests have been performed for this "first of its kind" facility? What were the outcomes? Nothing has been provided.

It is reckless and dangerous to place this untested facility in the middle of a residential neighborhood. In between homes, families, children, and the elderly. Every night you turn the news on and see violent crimes and shootings being committed by individuals suffering from mental illnesses. It is an uncertain world. The one place we have left for solitude, safety, and peace of mind is our home. The place where we raise our children. The place where we host family gatherings. The place where we turn our lights off and rest every night. The place where we retire. That feeling of safety, peace of mind, solitude would no longer be the case for the residents here. The facility absolutely poses a threat to the safety of the residents surrounding the property and how we live our everyday life.

I've gone through the meeting packets reading the letters of support for the foundation. The one thing they have in common is none of the letters have come from individuals surrounding the property. Some come from individuals who live in a gated community. Some are from individuals who don't live in this Township. They don't live HERE. They don't raise their children HERE. They don't sleep HERE. Our concerns are real, they're genuine, and they're legitimate.

The proposed facility goes against the intended uses and development within a rural district of our Township as defined by our Master Plan and Zoning Plan. It poses a threat to the safety and general welfare of the residents directly surrounding the property. It would set terrible precedent moving forward for all land usage in our rural district. The residents here have invested their livelihoods into this township and their property. We rely on elected officials to protect the investment we have made into our property, to protect our safety. We pay taxes to the Township's legal fund to defend the Master Plan. Please uphold the promise you have made to us. Thank you.

Superior Township Board and Planning Committee,

My family and I are Superior Township residents living on Warren Rd, about half a mile from 3900 Dixboro. I am writing to state that I oppose the proposed rezone at 3900 Dixboro Rd.

If permitted to go through this block of A-2 zoning will be gerrymandered just like many federal congressional district maps. Zoning that will make no sense from a geographic standpoint, but instead is just the artifact of some other competing interest(s). The underlying pending real estate transaction and subsequent rezoning petition feels like tail-wagging-the-dog township planning. Please evaluate this rezoning request based on Superior Township needs, not what a single buyer and seller of a multi-million dollar bundled up parcel deem the township's needs to be.

The rezoning application goes through great lengths to maintain how this is a "low density" or "extremely low density" development. Is this a Toll Brothers townhouse complex? No. Will it be an order of magnitude greater density than any of it's adjacent parcels? Yes. Please factor in adjacent parcels when evaluating lot density.

No other rural residential lot in the area has:

- a single family house (the admin building in the plans)
- a 20 person dormitory for short-term overnight guests (residence center in the plans)
- a barn for animal purposes
- another [existing] pole barn with garage bays (called a shed in the plans).
- 3 wells to provide enough peak water supply for up to 50 people and animals
- septic system capable of handling peak water usage patterns of up to 50 people
- 54 parking spaces

To say that this blends seamlessly with the surrounding area is a bit of a leap. From an overhead satellite view of the Superior Township parcel map, it will be pretty easy to spot which lot is not like the others.

The stated phases of this facility are confusing and seem intentionally vague. Will there be additional zoning rule changes that will be required as these additional phases are activated? Will there be additional unspecified phases? What type of licensing or oversight will this facility be beholden to at each of these phases? Please ask for details where details are omitted. Details matter to those of us living in the area.

Thank you for considering this letter in your decision, and doing your due diligence in making sure our neighborhood in Superior Township continues to be a place we all love to call our home.

- Anton Suarez

On Apr 17, 2023, at 9:43 AM, Beth Ann Hamilton <eahamilton211@gmail.com> wrote:

> You don't often get email from eahamilton211@gmail.com. Learn why this is important

Dear Ms. Findley,

My name is Beth Ann Hamilton and I'm a Ypsilanti Township resident writing in support of Garrett's Space's new non-medical residential space in Superior Township.

Garrett's Space does incredible work to provide a space for healing to young people in our community. We have been in the midst of a worsening mental health crisis for years. Depression, anxiety, and suicidal ideation are unfortunately incredibly common. As an employee of the Washtenaw County Health Department, I see firsthand how this impacts the lives and health of my neighbors.

Frankly, it is dangerous to actively stand in the way of building new spaces for mental health support. Mental health support and treatment saves lives. As a community, we should be doing all we can to increase access to these resources.

So many of my loved ones could have benefited from a space like the one Garrett's Space is envisioning. My best friend, my college roommates, my little sister. Even myself.

Young adults in Washtenaw County deserve to live in a community that actively works to improve and potentially save their lives. I hope you will use your power to be a part of making that happen.

Thank you for time and your public service,

Beth Ann

Skyland Trail

Offering Hope, Changing Lives

April 14, 2023

Lynnette Findley, Township Clerk
Superior Township
3040 North Prospect
Superior Township, MI 48198
lynettefindley@superior-twp.org

Dear Ms. Findley and fellow Trustees,

I am the President and CEO of Skyland Trail in Atlanta, Georgia and am writing in support of Garrett's Space proposed residential facility in Superior Township, Michigan. Skyland Trail is a community based behavioral health treatment program for adults and adolescents ranging in age from 14 to 70+ years of age. We operate 6 campuses in Atlanta, each located within or adjacent to a residential community. Across these campuses we provide residential services (105 beds), day and evening treatment programming, a variety of adjunctive therapies (i.e. art, music, horticulture, recreation), return to school/work programs, and a primary care clinic to manage our clients' physical health needs. Our programs are all voluntary and the campuses are unlocked. The majority of the adults we serve are young adults (ages 18-25) and are experiencing anxiety, depression, and bipolar disorder.

Skyland Trail opened its first campus in 1989 after great opposition from the neighboring community – and then opened subsequent campuses in 1991, 1998, 2004, 2016, and 2019, each bringing high pitch resistance and opposition from the various neighborhoods, but thankfully, in declining decibels over the years. To my delight, all of these campuses continue to operate with the strong support of the surrounding communities. Each neighborhood has experienced the great care we bring to our campuses through tasteful design and quality construction, beautiful grounds and landscaping, and respect for the people we serve and the communities in which we operate. Because of the property improvements made by Skyland Trail at each of our campuses, property values have increased over time after we have come into a neighborhood. There have been no negative incidences between our clients and the neighbors, and in fact, Skyland Trail has become an integral part of each neighborhood, hosting plant sales, art shows, 5k walk/runs, and community education programming – all on our treatment properties.

I urge you to support the development of Garrett's Space. The fears of the community are unfounded and most importantly, the need is great. As I am sure you hear every day, mental illness is a growing issue across our county and access to quality care is increasingly challenging. The people we serve at Skyland Trail and the people being served at Garrett's Space are just like you and me; they want a safe place to live, they want friends, and they want meaningful activity in their lives. They have hope for their future, hope for their recovery, and hope that society will give them a chance. I am hopeful you will give this project a chance with your full support. Please feel free to reach out to me if you have any questions.

Sincerely,

Beth Finnerty

Beth Finnerty
President & CEO

On Apr 17, 2023, at 4:45 PM, Cotzin Bette <bcotzin@gmail.com> wrote:

> You don't often get email from bcotzin@gmail.com. Learn why this is important

The Sunday edition of this week's Ann Arbor News published an article by Jordyn Pair elucidating the increasing rates of youth suicide. Included in the article is preliminary data from the Washtenaw County Medical Examiner Office indicating that 11 people younger than 25 committed suicide in 2022. This is tragic. Garrett's Place is designed to help prevent suicide through an intense wrap-around approach. Please save lives by approving the application submitted by Garrett's Place!

Bette Cotzin
bcotzin@gmail.com

Superior Township Board of Trustees and Planning Commission 13 April 2023
3040 N Prospect Road
Superior Township, Michigan 48198

Dear Trustees and the Planning Commission,

We want to voice our strong opposition to the rezoning of the parcel at 3900 Dixboro Road for the development of a temporary home and outpatient clinic for suicidal and distressed adults. We moved into this area because we were attracted to the natural beauty and peacefulness of the area. This neighborhood is removed from the hustle and bustle of Ann Arbor and provides its residents with a respite from the busier environments many of us work in. In particular we selected our house exactly because it is nestled in the forest away from the urban environment of Ann Arbor. If we had wanted proximity to the city and the combined advantages and disadvantages that a more urban environment provides we would have chosen a place in Ann Arbor. This rezoning proposal threatens to change the neighborhood we chose into one we were trying to avoid without our approval.

At best this rezoning request can be viewed as a proposal that benefits one seller and one buyer at the expense of the entire neighborhood. This property has been on the market for several years with an asking price that has attracted no buyers. Garrett's Space offers a deep pocket buyer for the seller at a price that the residential buyer pool is not able to meet. Letting the highest bidders shape the direction of Superior township is not good plan of action for the people who live here or for that matter any other township or city.

Let us be clear, Garrett's Space is a noble cause, and we support their vision and mission. However, we are still opposed to any rezoning effort in our neighborhood because it opens the door for unknown change in our neighborhood. There are several large plots of land that, if this rezoning proposal goes through, could be accommodated, and then repurposed in a similar manner leading to an irreversible change in the complexion of our rural, peaceful community one parcel at a time.

The idea that this Garrett's Space proposal is being cast as a planned community is also problematic and would set a precedent for the misuse of the planned community zoning designation in Superior Township. Garrett's Space is not being honest that this is really a medical service where they will be seeing drop in patients on a daily basis and housing a selected cohort as inpatients. Simply saying that it is a planned community does not make it so and we encourage the Trustees and Planning Commission to consider the future ramifications of such wide interpretation of the Planned Community designation.

Since Garrett's Space is taking this tact of casting what they may be doing as something else, details on what they actually intend to do are lacking. Once any rezoning is done there seems to be little incentive for them to work together with the neighborhood or Superior Township on any coordinated and respectful plan. We have heard the neighborhood's concerns being labeled as fear at a recent Planning Commission meeting but it is likely because Garrett's Sapce

has not been clear and forthright with the neighbors and this portends a constantly adversarial interaction between the two parties.

We want to repeat that this is not about Garret's Space. If the property at 3900 Dixboro was to be sold to build a small shopping mall we would be against any rezoning to accommodate it. If the property was to be sold to a company wishing to put a manufacturing facility requiring rezoning we would rally against it. If a gas station was proposed to be placed on the corner of Dixboro and Warren we would be opposed to it. All of these changes and this Garrett's Space proposal are at odds with the spirit of the Superior Township Master Plan and the current property usage in our neighborhood.

We are steadfast in our desire for the Agricultural A2 designation in all properties in our current area to remain Agricultural A2 in order to preserve the neighborhood we know and love. Because of all these reasons we strongly encourage the Trustees and Planning Commission to reject this proposed rezoning.

If you have any questions and would like to contact us, feel free to call us at (206) 437-1374

Sincerely,

Brian and Sabrina Carlson
5500 Warren Road
Ann Arbor, MI 48105

From: CAROL HOFFER <hoffera2@aol.com>
Sent: Thursday, April 13, 2023 2:57 PM
To: Lynette Findley <lynettefindley@superior-twp.org>
Cc: Halpert Julie <jhalpert333@gmail.com>
Subject: Garrett space support

[You don't often get email from hoffera2@aol.com. Learn why this is important at https://aka.ms/LearnAboutSenderIdentification]

I am a clinical s social worker with 20 years experience in the in the area. I am writing you today as a friend of numerous families like the Halpert's that I've had the agony of a child die by suicide those families gave every resource possible to support their child and the work of the helpers to support other peoples children should be commended. One friend in California did not answer her phone for five years after her son overdosed she , she felt she could have rescued him. Then she went forth after five years and started a therapeutic riding program in Mendocino California. This has given her a life back. It did not bring her son back. We need to support the young people who have so much to give to the community in the future if this was your neighbor, you would want to help them out, knowing that the child was raised by wonderful caring parents

Carol Hoffer Acsw

Carol Hoffer, CLU, CASL
Senior Agent, Northwestern Mutual
22 Haverhill Ct
Ann Arbor, MI. 48105

Please use carolhofferaa@gmail.com for all future correspondence

April 16, 2023

Lynette Findley, Township Clerk Superior Township
3040 North Prospect Superior Township, MI 48198
lynettefindley@superior-twp.org

RE: Garrett's Space

Dear Ms. Findley,

My wife Ginger and I reside at 3662 Vorhies Rd. in Superior Township, close to the proposed location of Garrett's Space.

We would like to ask you to support this crucial need within our community.

As you all know most of us have family or friends who have been severely affected by the mental health crises facing our world today. Personally, we had a dear friend who was a senior at Huron High School who took his life after struggling with depression. Our family and son were close friends of this student and have been trying to cope with the void in our lives from his departure!

We know that if a resource like Garrett's Space had been available to help our friend, he might still be with us today!

Thank you for all that you do in support of the community that we live in!

Sincerely
Dave and Ginger Raymond

On Apr 16, 2023, at 3:02 PM, Fresco, David <fresco@med.umich.edu> wrote:

> Some people who received this message don't often get email from fresco@med.umich.edu. Learn why this is important

Dear Ms. Findley and the Planning Commission,

I am not a resident in your community, but I am a faculty at the University of Michigan in the Department of Psychiatry. My faculty office is nearby at the Rachel Upjohn Building.

I gather there is a vocal segment of residents near the proposed property site, who are expressing concerns about personal safety and risk to property values. These concerns are understandable though I am hard pressed to fully grasp the evidence favoring these concerns. It seems to me that when we raise the level of mental health the level of our community and society, we actually add value financially and otherwise.

I hope you all have a robust and respectful discussion that allows the dissenters a chance to express their views. Still, I wish to add my voice to faculty colleagues, friends, and neighbors, who enthusiastically support the expansion plans for Garrett's Space.

Sincerely,

David Fresco
Ann Arbor, MI 48103

David M. Fresco, Ph.D.
Professor
Department of Psychiatry
2559 Rachel Upjohn Building
4250 Plymouth Road
Ann Arbor, MI 48109-2435
https://medicine.umich.edu/dept/psychiatry/david-m-fresco-phd/

Research Professor
Institute for Social Research
https://d3c.isr.umich.edu/

DATE: April 17, 2023

TO: Superior Township Board and Planning Commission

FROM: David E. Rutledge, Former Superior Township Supervisor and Former State Representative (54 Dist.)

REFERENCE: Support for Garrett's Space Residential Center

I have read with interest the news reports of both pro and con comments voiced by some Superior Township residents regarding a proposed rezoning of 76 acres of agriculturally zoned land. The rezoning would permit a non-profit call Garrett's Space to site a residential center with a mission to reduce suicide and fill critical gaps in supportive care options for young adults ages 18-28. Most all the comments I read were supportive of this mission, however, some voice opposition to the rezoning with comments such as:

- "The center is inconsistent with the agriculture nature of our township."
- "The center is incompatible with nearby subdivisions".

Because we tend to fear change—or what we don't understand—or what we can't visualize, these type comments aren't new or surprising to me. I've heard them before when I was the township supervisor. At that time and in the face of loud opposition, a courageous township board rezoned some agriculturally zoned acres to a Technology Center Park. That area is now home to the Hyundai American Technical Center and helping to diversify the township's tax base in addition to creating good paying jobs. I heard these same comments again when there was considerable opposition to locating a residential home to house handicapped and mentally impaired young adults on west Clark Road. Again, the township voted to rezone the acreage and many young adults not only found hope, they also found a caring and sharing community.

I am supportive of the Garrett's Space Residential Center rezoning proposal because it reminds me of the things I hold dear about Superior Township and its residents. Most residents tend not to embrace a "not in my back yard" attitude when it comes to doing our part to address community issues. Superior Township offers a good quality of life, and we will fight to keep it. In my view, this propose adds amenities to a parcel of land and preserves open space while also addressing a community issue that should be of concern to each of us. The proposal I've reviewed calls for connected buildings that house space for program/activities, administration/community, as well as a residential wing. In addition, there are walking trails, garden areas, gazebos, and areas for lawn games. If this land is going to be sold and rezoned, this seems to me to be an ideal way to preserve a tranquil wooded area. Just to our east, I've seen what a developer could do to acreage like this.

From: david wiss <davidwiss@gmail.com>
Sent: Thursday, April 13, 2023 8:34 AM
To: Lynette Findley <lynettefindley@superior-twp.org>
Subject: Objections to refining 3900 Dixboro

Dear Ms. Findley,

I am writing to express my opposition to the rezoning of 3900 N. Dixboro.

Garrett's Space is attempting to circumvent our Master Plan and our laws by attempting to rezone this single use as a plan community. Our A-2 zoning allows agricultural areas and large lot residential. It does not permit large group housing nor transient housing. It does not allow medical services and Garrett's Space is clearly a short term residential facility treating those who are unwell.

The rezoning application is extraordinarily and intentionally vague. It raises more questions than it answers-what are the ages of the patients? how many day user per day exactly are they talking about? will parking be sufficient given the unknowns with day users and will run off be exacerbated if the lots are increase? how will security be handled with skeletal staffing? They believe the woods and creek are sufficient boundaries, when in fact, any neighbor near them knows that they are both easily breached. They offer no solution for the light and sound pollution they are likely to generate.

I hope the Trustees do the right thing and deny the rezoning petition. That is the right precedent for our neighborhood and the right precedent for our township.

David Wiss
Fleming Ridge Dr.

On Apr 17, 2023, at 4:46 PM, Deano Smith <drsmith@greenhillsschool.org> wrote:

> You don't often get email from drsmith@greenhillsschool.org. Learn why this is important

Dear Ms. Findley and members of the Planning Commission,

I was a proud resident of Superior Township for seventeen years, and was pleased to meet you when I came by the township offices with various pieces of business over a number of those years. Our township was (and is!) indeed Superior, and that has been evident in the way you and our other officials run things. Thank you.

I am writing this afternoon to support the proposed rezoning for Garrett's Space to create a non-medical, residential facility in support of youth mental health. I feel very strongly that such a facility could have made a difference for my son Lucas Atkinsmith, who struggled with anxiety and depression, and died by suicide just last September, at the age of 24. To have a place that wasn't his parents' home, but where he could be supported in healing and "finding his way" among other young adults -- to know that he wasn't the only one struggling, and that there are people other than his parents to talk with and turn to for help -- would have been huge for him. I'm so very sad that we weren't able to provide something like that, but I'm hopeful that we can, as a community, do it for others. That's the Superior Township that I was a part of, and where so many of my friends still live. And we should all help them, and their children and grandchildren, keep living.

In my professional life as a school administrator and teacher, I am touched by the mental health crisis we face in this country on a weekly basis. It is paramount that we, as individuals and as a society, do all that is in our power to support our young people in need. Supporting a place for them to find healing and community is one step we can all take. And I urge the Planning Commission to please, please take that step, for all of us.

Sincerely yours,
Deano Smith

--

GREENHILLS School
ONE OF A KIND

Deano R. Smith, Ph.D. (he/him)
Head of Upper School
Greenhills School | Ann Arbor, MI
O: 734-205-4095

850 Greenhills Drive, Ann Arbor, MI 48105 | greenhillsschool.org

On Apr 17, 2023, at 4:03 PM, R DF <rflowers@emich.edu> wrote:

> You don't often get email from rflowers@emich.edu. Learn why this is important

Hi Dr. Findley,

I hope we might schedule a time to chat prior to the April 26 meeting.

University initiatives: I am currently working with the President's Task Force for Action on Intersectionality, AntiRacism, and Equity to begin a subset of this task force to focus on Mental Health and Equity. I am currently working with the University of Michigan Healthy Minds Network, The JED Foundation, and the Scott Fund on coordinated efforts across campus to Build a Community of Caring. We will be beginning the first steps in this process this fall with a program through the Faculty Development Center, Creating Classrooms of Caring. When I began this work this past fall, I came to know Scott and Julie Halpert and the idea for Garrett's Space. Danny could have benefitted from such an environment as some of his experiences with "medical" in-patient facilities were so dehumanizing.

This past week, I was recognized for my 20 years at EMU. It brought me back to when I was a GA working for you in the Holman Learning Center!

Thank You,

Dr. Ron Flowers
Professor - Higher Education Student Affairs
Department of Leadership and Counseling
John W. Porter Building, Suite 304
734-487-0255

From: elizabeth ayers <outlook_F5A1EACC1B827CFE@outlook.com>
Sent: Thursday, April 13, 2023 12:10 PM
To: Lynette Findley <lynettefindley@superior-twp.org>
Subject: Urging support for Garrett's Space at the April 26 meeting

My niece, Sarah, died by suicide 18 months ago. For ten years, she and her family struggled to find consistent care for the depression that resulted from being raped in college. Prior to that period, she'd been an active participant in sports and activities throughout her careers at Tappan and later at Pioneer High School in Ann Arbor.

Both of her parents are in medical professions, very supportive in the lives of their children, and worked tirelessly to provide Sarah with counseling, in-patient treatment and daily support. The problem they encountered over and over during the ten years Sarah suffered from mental illness is that…….there….. were…….simply……too…….few……facilities, therapists or residential treatment centers to help her reset and regain mental health. When she went to the ER reporting severe anxiety or suicidal thoughts, their only option was to place her – even involuntarily- in a state-supported treatment center for 2 weeks. All of these facilities were understaffed and sadly in one such facility, Sarah was raped again by another, older patient.

Each treatment center had its own staff and its own pharmaceutical protocols so her medications were changed often with each new psychiatrist. Shortly before her death, having been released from a temporary facility, she was suddenly terminated by that psychiatrist because his patient load was too high. Having exhausted the few, inadequate treatment options and not able to find even a therapist, Sarah saw suicide as her only option.

I detail Sarah's story because it's a picture of our country's desperate need for more mental health support. I taught in a wealthy school district for 38 years and can affirm that no amount of money can adequately address mental health for our teens because there simply aren't treatment options.

60 years ago the Brighton community dared to address treatment needs for people suffering from alcoholism. Brighton Hospital became a gold-standard for treatment in our country, and its success – for patients, for families and for the community- led other communities across the nation to offer more treatment options.

20 years ago, two Beaumont employees created a non-profit called Angels Place with provides adult residential homes tucked within subdivision neighborhoods. Today there are 20 such homes. Many aren't even recognized by neighborhood residents because, with the adequate staff Angels Place provide, all function as great neighbors.

Similarly the 72 acres proposed for Garrett's Space can not only address a crucial need in our community, it can serve as a model for other communities, even while protecting and caring for green space in Superior County, and providing hope, safety and restoration for young people suffering from mental illness. Please help lead Superior Township toward this goal that benefits both the community and its residents.

Thank you for your time. Elizabeth Ayers

From: Emily Adkison <adkison.emily@gmail.com>
Sent: Thursday, April 13, 2023 3:02 PM
To: Lynette Findley <lynettefindley@superior-twp.org>
Subject: Successful Masterplan - It's working!

Dear Trustees,

I am your constituent, who lives at 5514 Warren Road, and am asking you to represent me.

*We moved to this area **loving the thoughtful masterplan.** We have three young boys, ages 5, 7 and 9. Our house backs up this 3900 Dixboro, within 50 yards. Our boys love running and playing in the woods and in the creek. There are lots of stick forts being built, right now. Since we moved in, there has been **an influx of families to this warren / dixboro area moving in.** I am concerned that this spot zoning will deter other young families from moving to the area. I am concerned that it will open a pandora box of other spot zoning request.*

*We love the master plan's thoughtfulness that has led to the increase in recent families. **The master plan is working!** We hope a family with young kids, especially boys, will one day soon call 3900Dixboro home.*

I am your constituent and ask that you continue to represent me. Stick to the masterplan. Ensure other families with kids want to move to the area.

Your constituent,
Emily Adkison-Hoyt

EASTERN MICHIGAN UNIVERSITY

April 12, 2023

Board of Trustees
Superior Charter Township
3040 North Prospect Road
Superior Township, MI 48198

Dear Superior Township Trustees:

Garrett's Space is seeking to build a residential center on land in your township. Some residents have expressed concerns about the placement of this type of supportive facility in a residential area. Unfortunately, as is far too common, these concerns are rooted in outdated information and stereotypes regarding young adults struggling with chronic mental health issues. We, the members of the Department of Leadership & Counseling at Eastern Michigan University, write to offer our informed opinions concerning the population served by such a facility. Our department is staffed by faculty who are licensed mental health professionals, as well as student affairs and K-12 educational professionals who have worked with children and young adults. We bring years of experience and research to bear on the impact of depression and anxiety on this population. Our professional experiences have led us to conclude that young people receiving services in places like Garrett's Space do not pose security threats to those in the surrounding area. Our personal experiences confirm what research studies have found.

It should be stressed that many of us, our family members, neighbors, and colleagues will struggle with mental health at some point in time. The most recent statistics from the Office of Health & Human Services offer these insights:

- One in five American adults have experienced a mental health issue.
- One in six young adults has struggled with a major depressive episode.
- One in 20 Americans battle a serious mental illness such as schizophrenia, bipolar disorder, or major depression.
- Half of all mental health issues begin to show their first signs by the age of 14.
- Three quarters of mental health disorders begin before the age of 24.
- Suicide is the 2nd leading cause of death for people ages 10 to 24.

Despite these facts, there remains a misconception that people with chronic mental illnesses are dangerous, violent, incompetent, or unpredictable. This misconception is inaccurate and dangerous. The truth is people with serious mental health issues are 10 times more likely to be harmed than to cause harm. Indeed, they often face greater discrimination that exacerbates their own problems rather than initiate problems.

COLLEGE OF EDUCATION - DEPARTMENT OF LEADERSHIP AND COUNSELING
John W. Porter Building, Suite 304 • Ypsilanti, Michigan 48197
Phone: 734.487.0255 FAX: 734.487.4608

Some might think that mental health problems are untreatable or character flaws and weaknesses. However, that is not the case. Research has demonstrated that the causes of mental health issues are as varied as the people who struggle with them. They include issues such as genetic predispositions, brain chemistry, physical and emotional trauma, and family history with mental illness. With proper treatment and care, young adults can manage or recover from mental health problems. When proper care is provided, they have lower medical costs, increased productivity, decreased disability costs, and become productive members of our communities. The truth is many people who have sought treatment for any mental health disorder are our neighbors, friends, and family.

Prevention and treatment are the keys to helping young adults become successful citizens of our communities. Fear and ignorance based on stereotypes and outdated information often delay services offered to our young adults and thus create a spiral into more serious problems that contribute to increased discrimination, higher suicide rates, and broken families who grieve the lose of loved ones. Garrett's Space seeks to break this cycle and offer new hope for those in need and contributes to the betterment of our communities.

There are many indications that having such a resource available will be helpful for the Township. In Ypsilanti, SOS Community Services, Ozone House, the Corner Health, and many other social services agencies integral to the community are located in residential areas. There have been no complaints and they have brought the community more compassion and sense of connection. Adolescent services are often sought after, particularly in these post-pandemic times when so many folks are struggling. It may serve as a gateway to be able to offer more wraparound services and lead to an overall healthier community that is an exemplar for others.

Sincerely,

The Faculty and Staff of the Department of Leadership & Counseling

TO: Superior Township Planning Commission
FROM: Fleming Creek Advisory Council
SUBJ: Review of rezoning proposal submitted by Garrett's Space
DATE: April 17, 2023

The FCAC met on April 6th to discuss the proposal and has the following comments and suggestions:

1. FCAC understands that if the proposal moves forward to the site plan review phase, it will be reviewed under the Washtenaw County Water Resources Commission Rules, which should ensure stormwater BMPs to mitigate the impact of the impervious surfaces. FCAC would like to have an opportunity to review the site plan submittal at that time.
2. FCAC is pleased to see that relatively few trees would be removed, and that the proposed development is making use of existing buildings to reduce new buildings and new impervious surfaces.
3. FCAC is very pleased to hear Garrett's Space's desire and interest in placing a conservation easement on the natural areas on the site, and that they do not plan any building in those natural areas. Under current zoning a large number of homes could be built, and with that much more clearing of trees, possible encroachment into the wetlands and Fleming Creek, much more impervious surfaces, and therefore much more impact to Fleming Creek. Garrett's Space has arranged with the Huron River Watershed Council to conduct a natural areas field assessment of the property to document the ecosystems on the site. This will give them and township reviewers more information about the ecological value of the natural areas on site.
4. FCAC recommends Garrett's Space consider options for a smaller parking area to further reduce impervious surfaces and land clearing. The current size assumes that each resident will have a car with them and therefore need a spot. Given that the residents will not be using their cars at all during their stay, we think the parking lots size could be reduced.
5. FCAC realizes that this area of the township is considered its "rural area," and that a rezoning from an "Agricultural" to a "Planned Community" designation may seem like a loss of that rural character. However, the Agricultural designation actually would allow about 40 houses on this site, vs. the proposed use, which would be 3 buildings, leaving the majority of the site in its current landscape of forest, wetland, and Fleming Creek.

Thank you for the opportunity to provide comment on these site plans.

*FCAC is a group of local landowners and agency representatives (including county, city, townships, the University of Michigan, and Huron River Watershed Council) formed by those with an interest in maintaining and improving the quality and health of Fleming Creek. Ann Arbor Township requires FCAC review of development proposals within the Fleming Creekshed.

DATE. 4/13/23

To: Board of Trustee's, Superior Township and the Planning Board, Superior Township

FROM: Gary DeBusscher, 3830 Vorhies Rd.

RE: For your considerations in the forthcoming discussions on the proposal to rezone for Garrett's Space, please let me make the following recommendations.

(1)
Regarding the: "20-foot Perimeter Setback," as seen in "Garretts-Space-Area-Plan-Reduced.pdf, Page 9/16:"

My recommendation:
Along the Garrett Space property lines that are shared with the existing home owners' properties, a Setback (buffer zone) is established that is 200-feet wide where possible, so as not to interfere with the boundaries of the proposed Phase-1 and Phase-2 developments. Other structures including Trails, cannot be built within that 200-ft boundary along shared property lines, nor can viable vegetation be removed.

These shared property lines are along the entire northern boundary between Wing Dr and Dixboro Rd, and along the southwest boundary immediately bordering the 3816 Dixboro Rd property.

Rationale:
- Scott Halpert, at the 3/22 Twsp Hall Meeting, emphasized that "the two safety attributes" afforded by their Plan, is (A) "the natural vegetation surrounding their developments" and (B) "the creek along the eastern edge of the property."
- 20-feet is not enough of a setback to assume this vegetation acts as a viable safety-barrier.
- 200-feet, in the opinion of different Superior Township residents that I have reviewed this with, is a viable setback for "natural vegetation to minimally impart a measure of safety."
- Any Plans for "Walking Trails" within any setback, defeats Scott's original assertion (A).

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(2)
My recommendation:
A) Exclude all "overnight (dormitory) stay capabilities or provisions" from the Garrett Space current proposal.
B) Any further "Additions/developments/buildings" on this (proposed, newly-combined) single 76.7-acre property," will be strongly discouraged.

Rationale:
(A)
- The "daily activities as outlined on Scott's GS website," are well-meaning activities that are purposely fulfilled during the daylight business hours.

- Overnight-stay for ~25 adults (18-25 y.o., legal adults) at the proposed-Center will require boarding, personal care facilities, food provision, etc., paid staff on-site, etc., and therefore becomes a dormitory, or a business/institutional facility or, depending on your definitions, a medical facility.
- Regardless of your perspective, the overnight-stay structures, facilities and required staff and services, are (or potentially will become) not within the existing Plans for either A-2 or PC zoning.

(B)

- The space and public service capacities required to meet Garrett Space's goals, as stated by Scott Halpert, are already at or exceeding present and future land use capacities as either A-2 or PC.
- In the GS plans, I see no limitations on the number of visitors allowed onto the property at any given time, day or night. Nor is there any proposal by Mr. Halpert to monitor any limitation on this or other matters.
- I see no traffic studies being proposed, and hence no desire to assess any consequences that may be in the best interests of the Township's communities.
- The Garrett Space website itself, expresses "no boundaries on the capacities or number of activities" to be engaged in on this property:
    - As Quoted: "*A space that welcomes everybody regardless of their background is exactly what we need.*"
    - As Quoted: *"I know that Garrett's Space will be a lifeline for so many young people who will use it as an opportunity to express themselves and to help one another."*
    - In the "Ann Arbor Observer, March-2023, Page 18/92," Scott Halpert is quoted: *We envision the day when there's a Garrett's Space East, a Garrett's Space West, maybe Garrett's Spaces all across the World.*"
- By my recommendation, any "plans to expand Garrett's Space" will expressly have to occur at other Garrett Spaces" and NOT at 3900 N. Dixboro.

Thanks again for your time and considerations.

- Gary DeBusscher
3830 Vorhies Rd.

REZONING 3900 N DIXBORO?
SO MANY QUESTIONS...

No bus routes! No sidewalks! No bike paths! Can the infrastructure handle the extra traffic?

This is re-zoning for a single use, not a planned community! How is this not illegal spot zoning?

Adults with mental illness are more likely to use illicit drugs and alcohol. How will Garrett's Space control alcohol and drug abuse?

Any quiet time policy?

...or weapons policy?

Garrett's Space says their patients may come from toxic situations... How will they protect patients from intruders?

Of all the land in Washtenaw County, Why did Garrett's Space choose a residential area?

How do 2 overnight staff keep 20 mood disordered people safe?

Have Garrett's Space people even walked the land? The creek is easily hopped in most seasons. Deer Paths dot the area. There are no secure boundaries.

Why can't the Directors provide any peer reviewed research?

Psychological misdiagnosis is extremely common. How will Garrett's Space prevent that when screening patients?

How sustainable is this project? Garrett's Space needs millions more to build their facility and estimate 2 million a year to operate it.

This sets a terrible precedent for the Township. Is this the future of rural Superior Township?

Why does Garrett's Space keep changing its mission? How will it change once they get rezoned?

What is Garrett's Space doing to mitigate noise and light pollution?

Zoning runs with the land. Why does Garrett's Space keep saying if they leave, it reverts to agricultural?

Garrett's Space has had the property under contract since June. Why didn't they get neighbor input then?

No License? Unregulated? Unsafe?

The proposed patients will be adults. Will they come and go on their own volition?

If redevelopment is so likely, why has the land been listed for sale since 2014?

If the site is part of the Fair Housing Act, why aren't the trails ADA compliant?

...NO GOOD ANSWERS

Find out more at www.smallgroupofneighbors.org or scan our QR code with your phone

Image created by Freepik.com

The many ways traffic noise is damaging your health

Too often we've treated traffic noise simply as an annoyance. A growing body of research tells us it's a whole lot worse than that.

HIGHWAYS & INFRASTRUCTURE

EXPLAINER
OCTOBER 18, 2022

Edvard Munch | Public Domain

James Horrox
Policy Analyst, Frontier Group

Unwanted noise is annoying. I'm easily annoyed – and I'll admit that generally speaking I have no right to demand not to be. But does this mean that people like me should just get over ourselves and accept that the high levels of environmental noise we have to contend with as part and parcel of an urban existence are simply an inevitable fact of life?

It does not. Because when it comes to noise, the thing causing the annoyance also happens to be a major public health issue.

The average background noise level in a U.S. city is around 60 "A-weighted decibels" (dB(A)),[1] though there's substantial variation from city to city. A 2015 study in New York, for example, found an average street noise level of 73.4 dB(A), with levels reaching as high as 95 dB(A) in some places. Live within 50 feet of a highway and you'll typically be exposed to between 70 and 80 dB(A), according to the Federal Highway Administration. For context, according to the World Health Organization and the U.S. Environmental Protection Agency, 70 dB(A) – roughly equivalent to standing next to a washing machine – is the maximum noise level you should be exposed to over the course of a normal day to prevent hearing loss over the long term. But even noise as low as 35 decibels is enough to cause other issues, like sleep disturbance and disruptions to concentration.

The harms caused by noise, however, go way beyond that.

Research has shown, for example, that sustained exposure to high levels of noise leads to mental health problems of various kinds: a 2016 study of people living close to Frankfurt Airport found that noise is "strongly associated" with depression and anxiety, for instance. Those who reported the highest levels of noise annoyance were more than twice as likely to experience those two conditions than those reporting the least. A 2020 meta-analysis of studies exploring the link between transportation noise and anxiety similarly found 9% higher odds of anxiety per 10 dB(A) increase in noise level, further noting that the more severe the anxiety, the more significant the association. A separate meta-analysis, published in 2019, found that the risk for depression increased by 15% per 10 dB for aircraft noise and 4% per 10 dB for road traffic noise.

Perhaps more surprising is the extent of the impacts of noise on our physical health, which has also been the subject of a great deal of recent research – in particular regarding the relationship between noise exposure and cardiometabolic and cardiovascular diseases. A report from European research consultancy CE Delft estimated that noise from rail and road traffic could be responsible for up to 50,000 heart attack deaths and 245,000 cases of ischemic heart disease every year across Europe. A 2013 UK study concluded that daytime noise levels of 55 dB(A) and above could account for an additional 542 cases of hypertension-related heart attacks, 788 instances of stroke (see below), and 1,169 cases of dementia in the United Kingdom.

A number of studies have likewise established a link between traffic noise exposure and ischemic heart disease. A 2015 meta-analysis of studies of ischemic heart disease and noise from aircraft and road traffic found a 6% increase in risk per 10 dB(A) increase in noise exposure. A similar meta-analysis, published the previous year, looking at 14 studies of the relationship between traffic noise exposure and coronary heart disease, arrived at an estimate of 8% per 10 dB(A) increase in noise exposure.

A 2012 meta-analysis by researchers in Germany and the Netherlands found a 3.4% higher probability of hypertension per 5 dB increase in road traffic noise – a finding corroborated by several other studies. The association between hypertension and aircraft noise specifically has been studied fairly extensively – notably in a large-scale piece of research entitled "Hypertension and Exposure to Noise near Airports (HYENA)," drawing on data from almost 5,000 participants, which concluded that a 10 dB(A) increase in nighttime aircraft noise is associated with 14% higher odds of prevalent hypertension.

Some of the most worrisome conclusions come from a number of major studies on the relationship between noise and stroke risk. A 2011 study from Denmark, for example, based on a cohort of more than 57,000 individuals, found a "strong association" between road traffic noise exposure and stroke among people over 64.5 years of age. The study revealed that sustained exposure to road traffic noise increased stroke risk by 14% per 10 dB increase in noise level.

Studies conducted in London – one on traffic noise, another on airport noise – have come to similar conclusions, and a 2019 study from Barcelona found that not only are people living in noisier areas at a 30% higher risk of stroke, but high levels of noise also increase the severity of those strokes, noting that patients from noisier areas presented more severe strokes on admission to hospital.

Together, these studies – and the mountain of other research on noise and human health – paint a picture that legislators cannot, and should not, ignore. As yet another way that our transportation system is harming people, noise pollution should be right up there with air pollution and climate emissions as a key priority of 21st century transportation policy.

Noise ordinances are one measure that can be put in place to mitigate these harms (although such ordinances are at best only moderately effective – first because they're often not enforced in any meaningful way, and second because even when they are, the maximum permitted noise levels are often still way above the harm threshold). Noise cameras of the kind recently installed next to roadways in certain European cities could potentially be another – automatically slapping drivers of vehicles above a certain noise level with a ticket. It will be interesting to see the

results of the European pilots, as well as those set to be rolled out in some U.S. cities in the near future.

But these kinds of things are really only band-aid solutions. Bringing the volume down once and for all means tackling the problem at source: that is, by ending the dominance of the internal combustion engine – whether through electrification, and/or simply reducing the numbers of cars on the roads and planes in the sky. And it's not just transportation – take the leaf blower, for example: the scourge of suburbia, so much so that some cities have already implemented bans and others are on their way to doing so.

Too often we've treated noise as just an annoyance; an unavoidable feature of modern life that we just have to put up with. We now understand that it's much worse than that. It's time to act accordingly.

–

[1] Simply put, decibel (dB) is a unit of sound measurement that measures the straightforward loudness of a sound. However, the human ear does not hear all frequencies equally. dB(A) is a measurement of loudness weighted to take into account how the ear actually perceives sound. For an explanation of the physics involved, click here.

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The Sound of Heavy Traffic Might Take a Toll on Mental Health

A robust new study strengthens the link between loud traffic noise and depression.

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By Linda Poon
November 25, 2015 at 7:00 AM EST

Increasingly, health researchers are realizing that noise pollution is more than just a nuisance. A 2012 study found that exposure to the sounds of car traffic can raise the risk of heart attack in people over 50. A more recent study reported that it increases the risk of obesity. Still other work has linked city noise to impaired sleep.

But while these and other studies identify the effects of traffic noise on our bodies, few have looked at how it impacts our minds. New research, published in *Environmental Health Perspectives*, does just

that–providing strong evidence that noise pollution is indeed a mental health problem. The study found that people living in areas with high traffic noise were 25 percent more likely than those in quieter neighborhoods to have symptoms of depression, even when adjusting for socioeconomic factors.

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Using data from an ongoing population study, researchers in Germany looked at 3,300 people who showed no signs of depression when they were first surveyed between 2000 and 2003. All lived in three of the most densely populated cities in Western Germany. After participants retook the survey, five years later, the researchers looked for self-reported depressive symptoms, such as feelings of loneliness or sadness, as well as troubles with sleep or concentration. They also looked at whether the participants were taking anti-depressants.

When they compared that data with the noise levels of each participant's neighborhood, they found that more than a third of the sample were exposed to traffic noise at 55 decibels–equivalent to the noise level of an old dishwasher or chatter in a restaurant–or higher 24 hours a day. About a quarter were exposed to these levels only at night.

Participants with the most depressive symptoms were exposed to "intermediate" traffic noise 24 hours a day.

The mental health effects didn't differ between those who experienced loud traffic noise around the clock and those who only heard it at night (partly because researchers didn't have information about what noises each person was exposed to outside their homes). But they did find that participants who reported the most depressive symptoms were *not* the ones living in the loudest neighborhoods. That

distinction went to those who were exposed to "intermediate" traffic noise of 60 to 65 decibels for 24 hours a day.

It could be that people living in extremely loud areas are more likely to take measures to block the noise, Ester Orban, an epidemiologist at University Hospital Essen and lead author of the study, tells CityLab.

The groups most at risk of developing depressive symptoms were those who had lower income and education levels, and who were less likely to be employed. It could be that people who fit into those groups are more likely to live in louder neighborhoods, though the researchers say that particular link needs further study. "Low-income groups, which have been studied before, are more likely to have depression," Orban says. "But we can't say why the association between noise and depressive symptom is stronger in this population."

Orban adds that the link between noise and depression remains strong even after controlling for income and occupational status, which suggests the effect of noise on depression may be independent of monetary factors.

The researchers also saw a stronger correlation with depressive symptoms among those who reported sleep disruptions like insomnia in the first survey, suggesting that impaired sleep is a possible gateway to depression. "Insomnia is risk factor for depression and may be an indicator of mild depression that doesn't quite show up on the CES-D depressive symptom scale," says Stephen Stansfeld, a psychiatrist at the University of London and author of the book *Noise, Noise Sensitivity and Psychiatric Disorder*, who wasn't involved in the study.

Stansfeld says the the most significance recommendation to come out of this study is that more studies are needed. Researchers have evidence that noise leads to anxiety, and that it causes the release of the

stress hormone cortisol, but scientists can say very little about its effect on mental health. That makes it hard to come up with public health policies or even better street designs.

"There's very clear evidence that transport noise causes annoyances," he says, "so it's always a bit strange not to find strong relationships with mental health." But of course, he says, mental health outcomes have "lots of potential causes."

Top image: Cleanfotos / Shutterstock.com

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RESEARCH ARTICLE

WILEY ADAA

Night noise exposure and risk of death by suicide in adults living in metropolitan areas

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Background: Noise is defined as "sound that is unwanted, unpleasant, or harmful to health." It may induce negative emotions and mental health problems and even may leads to increased suicide risk. Little attention has been paid so far to a potential link between noise and suicide. We investigated the association between nighttime environmental noise and suicide death in adults in the Republic of Korea.

Methods: We analyzed the data from the National Health Insurance Service–National Sample Cohort, with a 4-year baseline (2002–2005) and an 8-year follow-up (2006–2013) assessment. A total of 155,492 adults constituted the study sample: younger adults (20–54 years, n = 124,994), or older adults (≥55 years, n = 30,498), and adults with mood and anxiety disorders (n = 34,615). Suicide death was defined as per International Classification of Diseases-10 code X60-X84. Data on nighttime noise were obtained from the National Noise Information System.

Results: During the study period, 315 (0.2%) died of suicide. The incidence of suicide per 100,000 person-years was 25.71. With interquartile range increases in nighttime noise, the adjusted hazard ratio (HR) for suicide death was significantly increased: 1.32 (95% confidence interval [CI]: 1.02–1.70) for younger adults, 1.43 (95% CI: 1.01–2.02) for older adults, and 1.55 (95% CI: 1.10–2.19) for adults with mental illness. In the penalized regression spline models, the HRs for suicide death were gradually increased with environmental noise levels, and the risk was the highest for adults with mental illness.

Conclusions: We found a significant association between exposure to nighttime noise and the risk of suicide death in adults in the Republic of Korea.

KEYWORDS
depression, epidemiology, international, stress, suicide/self-harm

1 | INTRODUCTION

Noise, defined as "unwanted, unpleasant, or harmful to health," is a ubiquitous type of environmental pollution that is receiving increasing attention as a public health issue (Basner et al., 2014; Ising & Kruppa, 2004). Noise-induced stress triggers a series of physiological changes mediated through the autonomic nervous system, leading to noxious symptoms and possibly to disease (Munzel, Gori, Babisch, & Basner, 2014; Stansfeld & Matheson, 2003). Research also suggests that noise can have a negative impact on emotions and mental health (Hardoy et al., 2005; Stansfeld, Gallacher, Babisch, & Shipley, 1996; Stansfeld & Matheson, 2003; van Kamp, Houthuijs, van Wiechen, & Breugelmans, 2007). Few studies have found that individuals who were chronically or highly exposed to noise were at greater risk of argumentativeness, nervousness, anxiety, and depression than those who were exposed to less noise (Beutel et al., 2016; Hardoy et al., 2005; Rylander, 2004; Stansfeld, Haines, Burr, Berry, & Lercher, 2000; Yoon, Won, Lee, Jung, & Roh, 2014).

Suicide is one of the most critical health consequences. Completed suicide is not only a personal tragedy but places economic, social, and psychological burdens on families, communities, and society as a whole (Hawton & van Heeringen, 2009; World Health Organization, 2014). Negative emotions and mental health problems (i.e., aggression or impulsivity, depression, and anxiety) have long been agreed upon as risk factors for suicide (Chesney, Goodwin, & Fazel, 2014; Hawton & van Heeringen, 2009; Min, Park, Hwang, & Min, 2015).

Suicidal desire may occur in a response to stressful conditions. Suicidal ideation can result from an impaired sense of subjective

well-being or from situations in which one lacks control over one's situations and environment (Daly, Wilson, & Johnson, 2007; Helliwell, 2007; Woo & Postolache, 2008). When an individual experiences psychological distress due to external sources or stressors and has difficulty in coping, the likelihood that suicidal behavior will emerge is increased. Therefore, noise exposure, which causes annoyance and psychological distress (Rylander, 2004; Stansfeld & Matheson, 2003; van Kamp et al., 2007), may contribute to an increased capacity for suicide. A recent study (Yoon et al., 2014) found that occupational noise annoyance increased the risk of suicidal ideation, suggesting a potential link between noise and suicide.

The aim of this study was to investigate whether chronic exposure to nighttime environmental noise is associated with suicide death in adults in the Republic of Korea. We conducted a prospective population-based study with a 4-year baseline (2002–2005) and an 8-year follow-up (2006–2013), assessing adults living in metropolitan areas over a 12-year period. Since the incidence of suicide is associated with age and with mental illnesses (Guldin et al., 2017), we categorized the study population into younger adults (20–54 years), older adults (≥55 years), and adults with mental illness and investigated the risk of suicide death associated with exposure to nighttime environmental noise.

2 | METHODS

2.1 | Data source and study population

We analyzed data from the National Health Insurance Service–National Sample Cohort (NHIS–NSC), a population-based cohort extracted from the Korean NHIS records (Lee, Lee, Park, Shin, & Kim, 2017). Details of the NHIS–NSC have been described in the previous studies (Lee et al., 2017).

From the NHIS-NSC (project number: NHIS-2016-2-0081), we identified 746,816 adults aged ≥20 years in 2002, of which 454,381 lived in metropolitan areas. We excluded 14,073 individuals with no data on personal characteristics or who had not undergone at least one medical examination during the baseline period (2002–2005), leaving 440,308 individuals. Of these, 284,816 subjects did not have complete medical examinations with information on health behaviors, including smoking, alcohol use, and physical activity. A total of 155,492 subjects thus constituted the study sample and were divided into two groups by age, as younger adults (20–54 years, n = 124,994), or older adults (≥55 years, n = 30,498). As a subgroup of the total cohort, we identified adults with mental illness (n = 34,615), that is, those diagnosed with mood or anxiety disorder based on the International Classification of Diseases (ICD) with ICD-10 codes F30 through F48.

2.2 | Outcome variables

Subjects whose death information was in the National Statistical Office's database and who had a code corresponding to X60 through X84 were considered to have died by suicide.

2.3 | Estimation of environmental noise exposure in metropolitan areas

Environmental noise is the noise pollution in communities caused by transport, industrial, and recreational activities, excluding that which originates at the workplace (Goines & Hagler, 2007). We used the database from the National Noise Information System (NNIS) of the Republic of Korea to assess the study population's environmental noise exposure. The NNIS is a nationwide environmental noise monitoring system that provide reliable environmental noise measurement data throughout the country and implements the noise reduction policy. This measure was in accordance with the Act on Environmental Testing and Inspection and observes the Official Test Standard for Noise and Vibration (Environmental Testing and Inspection Act).

Since the measurement of environmental noise was mainly conducted in cities having the greatest influence on the maintenance of citizens' normal living conditions, we considered the eight metropolitan areas, including Seoul, Gyeonggi-do, Incheon, Daejeon, Daegu, Ulsan, Busan, and Gwangju, as the study area.

The measurement period of environmental noise was on weekdays (Monday–Friday) with relatively few fluctuations on the days of the week in February and March, May and June, August and September, and November and December. Nighttime (11:00 pm–7:00 am) noise was measured at least twice at intervals of ≥2 hr for each measurement point. Values for nighttime noise were calculated by averaging of the measurements taken during each period. The measurement equipment was required to be of Class 2 noise level or equivalent performance, defined as standard C 61672-1 International Electrotechnical Commission in the Republic of Korea. The units of measurement were decibels (dB), with sound-level meters set to the A-weighting scale. The measurable range was from 35 to 130 dB.

The NNIS data provided noise data measured either automatically or manually. Since automatic noise data were available for relatively few monitoring sites, we used manually-measured noise data. The measurement points depend on the size of each metropolitan area; the number and mean distance of the manually-measured noise points varied in all eight metropolitan study areas: Seoul (n = 51; mean distance = 8.06 km), Gyeonggi-do (n = 152; mean distance = 30.88 km), Incheon (n = 30; mean distance = 5.65 km), Daejeon (n = 20; mean distance = 5.10 km), Daegu (n = 32; mean distance = 4.38 km), Ulsan (n = 33; mean distance = 6.27 km), Busan (n = 33; mean distance = 7.92 km), and Gwangju (n = 28; mean distance = 6.56 km). Data for the period from January 2006 to December 2013 were downloaded and used to calculate the monthly mean noise levels in nighttime (11:00 pm–7:00 am).

To estimate noise levels in unmeasured regions, we used geographic information system (GIS) tools and performed kriging regression as a spatial interpolation technique. Kriging is widely used in environmental epidemiological studies, especially of air pollution (Liao et al., 2006; Min & Min, 2017; Tsai, Lin, & Chen, 2009), but it has been also suggested as a superior method to predict noise properties (Taghizadeh, Zare, & Zare, 2013). We used the empirical Bayesian kriging (EBK) in the ESRI ARCGIS 10.4 software. Other methods of kriging interpolation use manual adjustment of the kriging parameters, whereas the

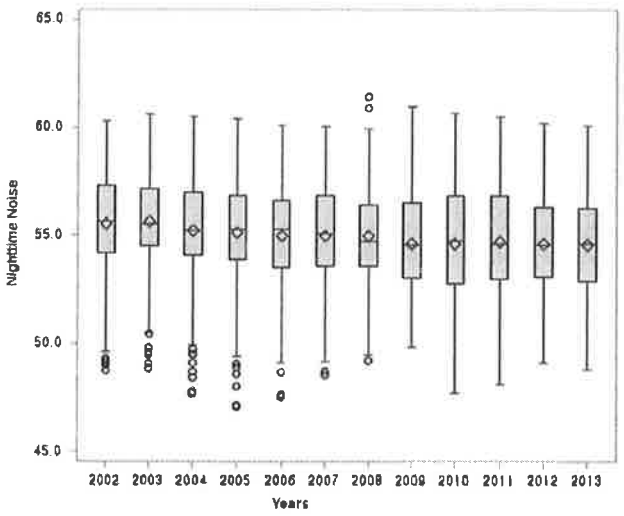

FIGURE 1 Annual mean distribution of nighttime environmental noise levels during follow-up period (2005–2013). Box plot shows the medians and the lower and upper quartiles. The arithmetic means are shown by diamond symbols, and extreme values are denoted by an "o" symbol

EBK automatically estimates these parameters using subsetting and simulations. The EBK estimate values based on semivariogram models that are derived from observed input data. Using Bayes' rule, the optimum weight for the "local" semivariograms can be calculated (Pilz & Spöck, 2007); as a result, the EBK model allows relatively more accurate predictions of nonstationary data from small datasets than others kriging methods (Esri, 2015).

After the kriging interpolation, we calculated the mean nighttime noise value at each zone in the eight metropolitan areas. Estimated noise levels in each zone were matched with district codes of individual residential addresses. If an individual moved to a new residence during the study period, his/her noise exposure levels were based on the area where he/she lived the longest time at a given year. The annual mean distribution of nighttime noise level throughout the follow-up period is shown in Figure 1.

2.4 | Variables

Baseline characteristics of the study population included individual variables (i.e., age, sex, residential area, household income, body mass index [BMI], exercise, smoking, drinking, and Charlson comorbidity index [CCI]) and geographical area variables (i.e., disposable income, proportion of the population engaged in economic activity, and particulate matter of 10 μm[PM10] or less).

For individual variables, demographic variables included age stratified in 5-year increments, sex (male or female), and household income according to the percentiles of taxed income in the Republic of Korea (<25%, 25–50%, 50–75%, and >75%). Residential areas were classified into seven cities (i.e., Seoul, Incheon, Daejeon, Daegu, Ulsan, Busan, and Gwangju) and one province (i.e., Gyeonggi-do). Information on BMI and health behaviors were derived from health examination data completed between 2002 and 2005. BMI was categorized as "underweight to normal weight (<24.9 kg/m^2)" or "overweight to obese (≥25.0 kg/m^2)." Health behavior variables included smoking history (current, former, or never smoked), exercise (yes or no), and alcohol consumption (yes or no). As a chronic disease index, the CCI scores developed by Quan et al. (2005) were calculated from medical records in 2002 and divided into the three categories: 0, 1, or ≥2 (Quan et al., 2005).

The geographical area variables were obtained from the Korean statistical information (https://kosis.kr/index/index.jsp). For economic status, disposable income per person (personal income minus taxes from the full amount of personal income of each year) and the percentage of individuals in a population participating in economic activity were derived from local statistical records. Air pollution was reported as the concentration of (PM10) or less.

2.5 | Statistical analysis

Study population was classified into adults (20–54 years), older adults (≥55 years), and adults with mood and anxiety disorders (ICD-10: F30-F48). Because no a priori hypothesis about the roles that mood and anxiety disorders play in the relationship between noise and suicide can be formulated, we separately analyzed subjects with mood and anxiety disorders to assess the likelihood of suicide death associated with noise exposure.

We compared the baseline characteristics of individual and geographical area variables between the censored population and the cases of death by suicide. Categorical variables were analyzed with a Chi-square test and continuous variables with a *t*-test. To estimate suicide risk in each group, the incidence of suicide deaths per 100,000 person-years was calculated with respect to the duration of follow-up (either the year of suicide death or the end of the study period, 31 December, 2013). The interquartile range (IQR) for nighttime median noise levels in each zone was calculated. We conducted Cox proportional hazards regression for multivariable analysis of the occurrence of completed suicide with each IQR increase of noise exposure (2.67 dB at night) until suicide or the end of the study period. Hazard ratios (HRs) with 95% confidence intervals (CIs) for suicide death were generated for nighttime IQR increase. In the adjusted regression model, age, sex, residence area, income, BMI, smoking, alcohol use, exercise, CCI, disposable income per person, economically active proportion of the population, and PM10 were included as potential confounding variables. The proportionality assumption was tested using the Schoenfeld residuals. The residuals were not correlated with time and with the Cox proportional hazards regression model by the stratification of covariates that satisfied the proportional hazards assumption ($P > 0.05$). All analyses were performed using SAS 9.2 software (SAS Institute, Cary, NC), and the statistical significance level was set at $P \leq 0.05$.

3 | RESULTS

Of the 155,492 subjects in the study cohort, 315 (0.2%) died of suicide. Baseline characteristics of the censored population and those who died by suicide were compared (Table 1). Individuals who

TABLE 1 Baseline characteristics of the study population comparing the censored population with those who died by suicide (n = 155,492)

Variables	Censored population (n = 155,177)	Suicide death: Number of case (cases per 100,000 person-years)	P-Value
Individual level, number			
Age (years)			
20–24	10,519	8 (9.51)	<0.0001
25–29	17,916	15 (10.47)	
30–34	18,642	22 (14.78)	
35–39	19,671	34 (21.65)	
40–44	24,096	46 (23.96)	
45–49	19,718	36 (22.98)	
50–54	14,237	34 (30.23)	
55–59	11,219	26 (29.57)	
60–64	9,209	37 (51.97)	
65–69	5,639	27 (63.70)	
70–74	2,717	16 (82.51)	
75–79	1,119	11 (148.40)	
80–84	380	2 (95.88)	
≥85	95	1 (230.68)	
Sex			
Male	86,346	239 (35.14)	<0.0001
Female	68,831	76 (13.94)	
Residential area			
Cities	108,268	213 (24.92)	0.4062
Province	46,909	102 (27.52)	
Household income according to the percentiles of taxed income in Korea			
<25%	46,062	109 (30.04)	.1615
25–50%	29,961	51 (21.53)	
50-75%	35927	76(26.74)	
>75%	43227	79(23.15)	
Body mass index (kg/m^2)			
<24.9	102515	219(27.07)	0.1950
≥25.0	52662	96(23.07)	
Exercise			
No	67352	139(26.22)	0.7957
Yes	87825	176(25.32)	
Smoking status			
Smoker	41334	114(34.97)	0.0001
Non-smoker	113843	201(22.35)	
Alcohol drinking			
Non-drinker	67855	134(25.12)	0.6712
Drinker	87322	181(26.17)	
Charlson Comorbidity Index			
0	130581	247(23.90)	0.0002
1	19189	44(29.25)	
≥2	5407	24(58.08)	
Area level, mean (SD)			
Economically active proportion of the population in percent			
	11.59 (1.24)	11.56(1.20)	0.6103
Particulate matter of 10 micrometers or less (μg/m^3)			
	55.04 (4.34)	55.00(4.44)	0.8726

SD: standard deviation. A chi-square test was used for categorical variables and a t-test for continuous variables.

committed suicide were more likely to be older, male, smokers, and were having more medical problems (CCI ≥ 2). There were no significant differences in other individual characteristics (i.e., residential area, household income, BMI, drinking, and exercise) or geographical area characteristics (i.e., disposable income, economically active proportion of the population, and PM10).

The outcome of each group was analyzed, including the number of suicide and the incidence of suicide per 100,000 person-years. Of 124,492 younger adults (20–54 years), 195 died of suicide, for an incidence per 100,000 person-years of 19.61. Among older adults (≥55 years), 120 of 30,489 committed suicide, for an incidence per 100,000 person-year of 51.99, the highest among the three groups assessed. Among the 34,615 subjects with a diagnosed mental illness, there were 114 suicides for an incidence per 100,000 person-years of 42.34, higher than that among younger adults but lower than that of older adults. In the overall study population, the incidence of suicide per 100,000 person-years was 25.71 (Table 2).

The HRs for suicide death by IQR increases in nighttime environmental noise are provided in Table 3. The IQR of nighttime noise exposure was 2.67 dB and an increase by this amount was associated with increased HRs. After adjustment for all potential confounders (i.e., age, sex, residential area, BMI, smoking, alcohol drinking, exercise, CCI, disposable income per person, economically active proportion of the population, and PM10), the adjusted HRs of suicide death were 1.32 (95% CI: 1.02–1.70) for younger adults, 1.43 (95% CI: 1.01–2.02) for older adults, and 1.55 (95% CI: 1.01–2.19) for adults with mental disorders.

4 | DISCUSSION

This study investigated the association between exposure to environmental noise and suicide death in adults living in metropolitan areas in the Republic of Korea. The highest incidence of suicide death per 100,000 person-years, 51.99, was observed among older adults. After adjustment for all potential confounders, the HR for suicide death was significantly associated with IQR increases or linear increases of night time noise levels in all groups, and the HR for adults with mental disorders was especially high. Our study suggests a potential effect of nighttime environmental noise on suicide in adults, with those who suffer from mental disorders being particularly susceptible.

TABLE 2 Number of suicide death and incidence per 100,000 person-years

	Total population (n = 155,492)	Censored population (n = 155,177)	Suicide death		
			no. of cases	Total person-year	Incidence per 100,000 person-year
Younger adults (20–54 years)					
	124,994	124,799	195	994,321	19.61
Older adults (≥55 years)					
	30,498	30,378	120	230,834	51.99
Adults with mental disorders[a]					
	34,615	34,501	114	269,261	42.34

[a]Mental disorders were defined as ICD10: F30-F48.

TABLE 3 Hazard rations (95% CIs) for suicide death by interquartile-range increases in environmental noise levels

		Unadjusted model		Adjusted model[a]	
Nighttime noise	IQR increases	HR (95% CI)	*P*-Value	HR (95% CI)	*P*-Value
Younger adults (20–54 years)					
	2.67 dB	1.34 (1.05–1.71)	0.0178	1.33 (1.03–1.71)	0.0289
Older adults (≥55 years)					
	2.67 dB	1.11 (0.82–1.50)	0.4972	1.42 (1.01–2.00)	0.0462
Adults with mental disorders[b]					
	2.67 dB	1.29 (0.96–1.74)	0.0952	1.55 (1.11–2.18)	0.0110

IQR, interquartile range; HR, hazard ratio; CI, confidence interval.
[a]Adjusted by individual level data (i.e. age, sex, residential area, BMI, smoking, alcohol drinking, exercise, and Charlson Comorbidity Index) and area level data (i.e., percentage of economically active population and PM10).
[b]Mental disorders were defined as ICD10: F30–F48.

To our best knowledge, no other studies of environmental noise have examined the risk of suicide death in the general population, although there are few studies on the link between aircraft and occupational noise exposure and suicide (Meecham & Shaw, 1993; Yoon et al., 2014). Meecham and Shaw (1993) investigated the mortality risk associated with exposure to aircraft noise using data from 1970 to 1980 and found that people living near Los Angeles International Airport had higher risk of death from suicide (Meecham & Shaw, 1993). A recent large-scale study using the nationwide survey of the Republic of Korea reported an association between occupational noise and psychological symptoms (Yoon et al., 2014). In an active working population with severe annoyance, the likelihood for suicide ideation was significantly higher (odds ratio [OR] = 1.76; 95% CI: 1.29–2.40 for male and OR = 1.41; 95% CI: 1.01–1.97 for female) than those without noise annoyance. This risk was independent of sociodemographics and individual characteristics (Yoon et al., 2014). Although this study was limited by lack of information on absolute noise exposure and by its cross-sectional design, such pioneering studies are in accord with our findings of a potential link between environmental noise and completed suicide.

Why then, are people who are more exposed to noise at higher risk for suicide? This pathway remains unconfirmed, although it seems important to appreciate noise as a significant environmental stressor (Evans & Johnson, 2000; Stansfeld & Matheson, 2003). Noise-induced stress can disrupt the homeostasis of the central nervous system and the neuroendocrine system and consequently precipitate physical and mental health problems or worsen existing symptoms (Westman & Walters, 1981). Regarding mental health problems as risk factors for suicidal behaviors, anxiety and depression symptoms were more likely to be observed in people exposed to aircraft or traffic noise (Hardoy et al., 2005; Hiramatsu, Yamamoto, Taira, Ito, & Nakasone, 1997; Stansfeld et al., 2000; Yoshida et al., 1997), even though studies have shown inconsistent results (Kryter, 1990; van Kamp et al., 2007). Stansfeld et al. (1996) found that there was no longitudinal association between noise level and minor psychiatric disorders, but found a small nonlinear association between noise and increased anxiety scores (Stansfeld et al., 1996). Psychological effects of noise-induced stress have been experimentally ascertained. Naqvi, Haider, Batool, Perveen, and Haleem (2012) compared behaviors in male rats exposed to 15-day subchronic noise versus controls (Naqvi et al., 2012). The authors found that male rats exposed to noise had a significantly higher tendency toward anxiogenic and depressive-like behaviors than did controls.

An important addition is that noise exposure creates annoyance, leading to psychological symptoms (Stansfeld et al., 2000). Annoyance is the most prevalent response when people are exposed to noise and noise-induced annoyance creates a substantial disease burden. Indeed, approximately 587,000 disability-adjusted life years are lost in the Western European population (World Health, 2011). Schreckenberg, Meis, Kahl, Peschel, and Eikmann (2010) emphasized that determining the physical and mental health of residents exposed to aircraft noise is not simply limited to noise exposure but to noise annoyance (Schreckenberg et al., 2010). Recent studies have provided evidence that the degree of noise annoyance induced by exposure

to environmental or aircraft noise was associated with a significantly higher prevalence of depression and anxiety in the general population (Beutel et al., 2016; Hammersen, Niemann, & Hoebel, 2016).

Suicide has no single cause. As seen in our results (Supporting Information Table 1), the HR for suicide was significantly associated with individual level data. In both young adults (20–54 years) and older adults (≥55 years), the HR of death due to suicide was overall increased with age (highest HR in adults between 50 and 54 years and ≥85 years). The HR in females was lower than that in males, and the HR of adults with the highest household income (> 75%) was lower than that of adults with the lowest household income (< 25%). This finding is consistent with previous findings, suggesting that age, gender, and income are contributing factors in death due to suicide (Turecki & Brent, 2016). Unlike in young adults (20–54 years), older adults (≥55 years), those with a BMI of <24.9 kg/m2 and those living in provincial areas, had a greater HR of suicide death. Excess body mass is a known risk factor for chronic illnesses, but the association between BMI and suicidal behavior has not yet been clarified (Perera et al., 2015). Further study is needed to explore whether BMI contributes to the risk of suicide and whether any BMI-suicide link differs by age. In addition, the likelihood of suicide in older adults living in provincial areas was greater than those living in metropolitan areas. It is assumed that seniors in rural or provincial areas are more vulnerable to social isolation and interpersonal loss. This assumption suggests that social isolation and interpersonal loss in older people are risk factors for suicidal behavior (Beautrais, 2002; Suresh Kumar, P.N., Anish, & George, 2015). However, since metropolitan and provincial areas have characteristically different patterns of social support and resources, and noise levels in provincial areas are generally lower than those in metropolitan areas, more research is necessary to determine the residual confounders (i.e., characteristics of residence areas and the degree of social support/isolation) affecting the association between noise exposure and suicide death.

In adults with mental disorders, females had a lower risk of suicide than males. No other individual or area characteristics affected the likelihood of suicide. Although the presence of mental disorders has been reported as a strong predictor of suicidal behaviors (Nepon, Belik, Bolton, & Sareen, 2010; Nock, Hwang, Sampson, & Kessler, 2010), little is known about which aspects of mental illnesses affect the occurrence of suicidal behaviors. Admittedly, we cannot explain this association by our observational data because of unmeasured and confounding variables. Therefore, consideration must be given to association between mental disorder and the likelihood of suicide to further delineate the vulnerability of subjects suffering from mental disorders and the impact of noise on this risk.

We report a significant association between suicide death and exposure to nighttime noise in three cohorts—young adults, older adults, and adults with mental illnesses. However, the mechanism by which this association manifests is not yet clear. Considering that suicidal behaviors are a stress response and a serious consequence of mental health problems (Evans, Hygge, & Bullinger, 1995), and that exposure to noise is an important stressor with the potential to increase the risk of mental health problems (Stansfeld et al., 1996; Stansfeld & Matheson, 2003), it is unsurprising that exposure to environmental noise contributes to the risk of suicide. Further studies are needed to replicate our findings and address this hypothesis.

To our knowledge, this is the first study to demonstrate that chronic exposure to nighttime environmental noise may increase the risk of suicide in adults. Our study benefited from data from a large sample and a long-term assessment of noise exposure based on noise measurement data reported from where the subjects lived. However, several study limitations should be considered. The most critical issue is the methodology used to assess environmental noise. In epidemiologic studies, issues of particular concern are minimizing misclassification of exposure at unmonitored locations and improving individual exposure estimates. To overcome such a challenge, many studies have used GIS spatial analysis (Liao et al., 2006; Min & Min, 2017; Tsai et al., 2009). We applied GIS to extrapolate exposure levels of environmental noise and assigned individual noise exposure levels. Nevertheless, there remains a level of uncertainty in estimating exposure to environmental noise. Second, although the NHIS-NSC is a representative population-based cohort with a large sample (i.e., >1 million individuals) (Lee et al., 2017), it was not designed for the purposes of any specific study. For the current study, the exclusion of data from subjects whose personal characteristics were not included in the database may have introduced systematic bias. In particular, our study population included only adults living in the metropolitan areas to allow more accurate estimates of noise exposure because noise monitoring sites mainly exist in cities. Thus, our population living in the eight metropolitan areas studied is likely to differ from adults living in other parts of Korea. Indeed, we compared the characteristics of individuals included and excluded from the study and found significant differences in demographics (i.e., younger age) and health behaviors. Our results therefore cannot be generalized to subjects whose data were not included in the research. Third, the results were reported based on adjustment for several covariates (i.e., socioeconomic variables, health behaviors, and medically diagnosed diseases), but this may not have sufficiently accounted for all possible confounders. For example, people may have varying levels of noise sensitivity, that is, an internal state might affect the degree of noise-induced reactivity (Job, 1999). Noise sensitivity itself may be an important contributor to health effects (Fyhri & Klaeboe, 2009; Schreckenberg, Griefahn, & Meis, 2010). Moreover, exposure to loud occupational noise during the workday and differences in residential conditions (i.e., housing type and quality) are associated with noise annoyance as well as individual mental health status (Babisch et al., 2012; Gitanjali & Ananth, 2003). Thus, we cannot rule out the potential impact of unmeasured confounders. In future research, such considerations should be addressed to clarify the observed association between noise and suicide risk.

In conclusion, we found a significant association between exposure to nighttime environmental noise and the risk of suicide death in adults in the Republic of Korea. In particular, adults who suffered from mood and anxiety disorders had the highest risk of suicide associated with nighttime noise exposure. The effect of noise-induced stress or annoyance may be exacerbated in individuals who are already at high risk of suicide. Finally, it is unclear if there is a direct link between exposure to environmental noise and suicide or if the exposure indirectly increases the risk by contributing to an increased likelihood of suicidal behaviors.

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CONFLICTS OF INTEREST

All authors declare that they have no conflicts of interest.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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UPI

Traffic noise linked to higher risk of suicide

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Cara Murez, HealthDay News

Living with a lot of transportation noise can increase your risk of suicide, new research suggests.

A study from Switzerland found that with every 10-decibel increase of average road traffic noise at home, risk for suicides rose by 4%. An association between railway noise and suicide was less pronounced.

"We used suicides as an indicator for mental health disorders as we do not have robust Swiss data on mental health diagnoses such as depression or anxiety," said study co-author Benedikt Wicki, a PhD student at the Swiss Tropical and Public Health Institute.

"Noise increases the mental load, contributing to the development of mental disorders or worsening of preexisting conditions," he said in an institute news release.

Mental health disorders affect nearly 1 billion people worldwide, including about 1.4 million people in Switzerland. They are a leading cause of suicide, the authors noted.

In Switzerland, about 1,000 people die by suicide each year.

Past research has linked environmental factors like air pollution or noise to adverse health effects such as cardiovascular diseases and general well-being, but robust evidence on the effects of transportation noise on mental health disorders remains scarce, according to the study.

Biological mechanisms explaining why noise impacts mental health include sleep disturbance, increased levels of stress hormones, changes in brain function or a sense of loss of control.

"Our brain registers noise as a sign of a potential threat and activates a 'fight-or-flight' response. Constant transportation noise at your home can make you agitated and unable to cope with stress," said co-author Danielle Vienneau, a Swiss TPH researcher.

The researchers analyzed data from 5.1 million teens and adults ages 15 and up in the Swiss National Cohort from 2001 to 2015.

They also included noise exposure data from transportation sources including road traffic, railways and aircraft, available for all households in 2001 and in 2011. The authors assigned this noise data to the study participants based on their place of residence.

While the researchers found only an association, the results linking noise levels and suicide were robust even after adjusting for exposure to air pollution, the amount of greenness around homes and multiple socioeconomic indicators, according to the study.

The authors said the study underscores the importance of addressing the health impacts of transportation noise, air pollution and greenness in urban planning and public health policies.

The study was published Wednesday in the journal Environmental Health Perspectives. It was funded by the Swiss National Science Foundation.

More information

The U.S. Environmental Protection Agency has more on noise pollution.

HealthDay

Medical Xpress

Study links transportation noise to higher risk for suicides

March 29 2023

Credit: Pixabay/CC0 Public Domain

Mental health disorders affect nearly one billion people worldwide and are a leading cause of suicide. In Switzerland, it is estimated that about 1.4 million people are affected by mental health issues and that

approximately 1,000 people take their lives every year. Environmental factors such as air pollution or noise have been linked to adverse health effects such as cardiovascular diseases and general well-being. However, robust evidence on the effects of transportation noise on mental health disorders remains scarce.

For the first time, researchers from Swiss TPH have now evaluated the association of transportation noise with suicide in Switzerland. The study, published today in the journal *Environmental Health Perspectives*, analyzed data from 5.1 million adults in the Swiss National Cohort from 2001 to 2015.

The study found that exposure to transportation noise at home was linked to a higher risk of death by suicide. With every 10 dB increase of average road traffic noise at home, risk for suicides rises by 4%. An association with railway noise was also observed, although less pronounced. The observed results were robust even after adjusting for exposure to air pollution, the amount of greenness around home and multiple socio-economic indicators.

Noise as a constant stressor

"We used suicides as an indicator for mental health disorders as we do not have robust Swiss data on mental health diagnoses such as depression or anxiety," said Benedikt Wicki, Ph.D. student at Swiss TPH and first author of the study. "Noise increases the mental load, contributing to the development of mental disorders or worsening of preexisting conditions."

The biological mechanisms by which noise impacts on mental health include sleep disturbance, in-creased levels of stress hormones, changes in brain function or a sense of loss of control. "Our brain registers noise as a sign of a potential threat and activates a 'fight-or-flight' response.

Constant transportation noise at your home can make you agitated and unable to cope with stress," said Danielle Vienneau, Swiss TPH researcher and senior author of the study.

Data from 15 years of research

The study used data from 5.1 million people aged 15 years and above from the Swiss National Cohort from 2001 and 2015. The researchers compared this with noise exposure data from transportation sources including road traffic, railways, and aircraft. The noise exposure data were available for all households at 2001 and 2011, and were assigned to the study participants based on their place of residence.

Noise reduction measures pay off

The study underscores the importance of addressing the health impacts of transportation noise, air pollution and greenness in urban planning and public health policies.

"Our study adds to the growing body of evidence that chronic exposure to transportation noise impacts our physical and mental well-being," said Martin Röösli, Head of the Environmental Exposures and Health unit at Swiss TPH.

"Our study demonstrates that noise reduction measures such as speed limits, lighter vehicles, low-noise road pavement and tires pays off."

More information: Benedikt Wicki et al, Suicide and Transportation Noise: A Prospective Cohort Study from Switzerland, *Environmental Health Perspectives* (2023). DOI: 10.1289/EHP11587

Provided by Swiss Tropical and Public Health Institute

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Residential Road Traffic Noise and High Depressive Symptoms after Five Years of Follow-up: Results from the Heinz Nixdorf Recall Study

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Background: Traffic noise affects a large number of people, particularly in urbanized areas. Noise causes stress and annoyance, but less is known about the relationship between noise and depression.

Objective: We investigated the association of residential road traffic noise with depressive symptoms using 5-year follow-up data from a German population-based study.

Methods: We analyzed data from 3,300 participants in the Heinz Nixdorf Recall study who were between 45 and 75 years old and were without depressive symptoms at baseline (2000–2003). Depressive symptoms were defined based on the Center for Epidemiologic Studies Depression scale (CES-D) 15-item questionnaire (total score ≥ 17) and antidepressant medication intake. Road traffic noise was modeled according to European Parliament/Council Directive 2002/49/EC. High noise exposure was defined as annual mean 24-hr noise levels > 55 A-weighted decibels [dB(A)]. Poisson regression with robust variance was used to estimate relative risks (RRs) *a*) adjusting for the potential confounders age, sex, socioeconomic status (SES), neighborhood-level SES, and traffic proximity; *b*) additionally adjusting for body mass index and smoking; and *c*) additionally adjusting for the potential confounders/intermediates comorbidities and insomnia.

Results: Overall, 35.7% of the participants were exposed to high residential road traffic noise levels. At follow-up (mean = 5.1 years after baseline), 302 participants were classified as having high depressive symptoms, corresponding to an adjusted RR of 1.29 (95% CI: 1.03, 1.62; Model 1) for exposure to > 55 versus ≤ 55 dB(A). Adjustment for potential confounders/intermediates did not substantially alter the results. Associations were stronger among those who reported insomnia at baseline (RR = 1.62; 95% CI: 1.10, 2.59 vs. RR = 1.21; 95% CI: 0.94, 1.57) and appeared to be limited to those with ≤ 13 years of education (RR = 1.43; 95% CI: 1.10, 1.85 vs. 0.92; 95% CI: 0.56, 1.53 for > 13 years).

Conclusion: Our results suggest that exposure to residential road traffic noise increases the risk of depressive symptoms.

Citation: Orban E, McDonald K, Sutcliffe R, Hoffmann B, Fuks KB, Dragano N, Viehmann A, Erbel R, Jöckel KH, Pundt N, Moebus S. 2016. Residential road traffic noise and high depressive symptoms after five years of follow-up: results from the Heinz Nixdorf Recall Study. Environ Health Perspect 124:578–585; http://dx.doi.org/10.1289/ehp.1409400

Introduction

Noise is a psychosocial stressor that may affect health, even at low levels (Babisch 2002). A large number of people in urban settings are exposed to traffic noise, and the World Health Organization (WHO) considers environmental noise to be an important public health issue (WHO 2011). Beyond causing annoyance, exposure to traffic noise has been associated with stress-related and cardiovascular outcomes such as hypertension and myocardial infarction (Barregard et al. 2009; Fuks et al. 2011; Willich et al. 2005). Recently, an association of long-term exposure to traffic noise with incident diabetes mellitus type 2 has been reported (Sørensen et al. 2013). Until now, epidemiologic research on noise has focused mainly on cardiovascular effects, but less is known about the relationship between traffic noise and mental health problems such as depression.

Depression is a common mental disorder and an increasing public health concern (Weissman et al. 1992), and it is a leading cause of disability worldwide. According to results reported in the Global Burden of Diseases, Injuries, and Risk Factors Study 2010, mental and substance use disorders contributed 7.4% to the total global burden of disease [as measured in disability-adjusted life years (DALYs)] in 2010, of which 40.5% was attributable to depressive disorders (Whiteford et al. 2013). Individuals affected by depression not only experience reduced quality of life due to suffering but also may be unable to cope with everyday life tasks including performing occupational activities, which results in increased sick leave (Wedegaertner et al. 2013).

The etiology of depression is multifactorial and complex. Psychological, social, and biological factors may be involved, most likely in combination (WHO 2012). The potential influence of noise on mental health has been examined, but findings from studies of noise and mental health outcomes have been inconsistent (Crombie et al. 2011; Floud et al. 2011; Hardoy et al. 2005; Niemann et al. 2006; Schreckenberg et al. 2010; Sygna et al. 2014). These discrepancies may be attributed to differences in study design, investigated populations (children, adults), exposures (aircraft and road traffic noise and subjective noise annoyance as opposed to objectively modeled/measured noise), and outcomes (various psychological symptom measures/questionnaires, diagnoses, medication intake, mental hospital admissions). Few studies have examined the association between road traffic noise and depressive symptoms in adults, and there is a particular lack of evidence from prospective studies. To our knowledge, there is only one prospective study that has examined this association (Stansfeld et al. 1996). This study was conducted in Caerphilly, South Wales, and the authors found no association between traffic noise levels at baseline and depression scores after 5 years of follow-up; however, only men (n = 1,725) were included.

There are several proposed pathways supporting the hypothesis that chronic noise exposure may be related to depressive symptoms. Sleep disturbance conditions such as insomnia, which may be caused by traffic noise (Halonen et al. 2012), have been shown to be associated with depression in previous studies (Franzen and Buysse 2008; Riemann

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and Voderholzer 2003; Roberts et al. 2000). Thus, decreased quality of sleep represents one possible link between noise exposure and mental health. A recent cross-sectional study analyzing survey data for 2,778 adults from an age- and sex-stratified population registry sample in Oslo, Norway, found a weak association between road traffic noise and mental health as measured by the Hopkins Symptom Checklist, but only in participants with poor quality of sleep (Sygna et al. 2014). Furthermore, acute noise events cause biological stress reactions (Babisch 2002). Such stress reactions may in turn promote onset of depression (Anisman and Merali 2002; Wager-Smith and Markou 2011); however, single acute noise events are unlikely to cause depression. Thus, the question whether repeated or chronic noise exposure has long-term effects on depressive illness is unresolved.

The aim of this study was to investigate the association of long-term exposure to objectively measured road traffic noise with depressive symptoms within a population-based cohort of middle-aged men and women living in the highly urbanized metropolitan Ruhr area in Germany.

Methods

Study population. We analyzed baseline and 5-year follow-up data from the ongoing prospective Heinz Nixdorf Recall study (HNR) conducted in three large adjacent cities (Bochum, Essen, and Mülheim/Ruhr) located in western Germany. The study design has been described in detail elsewhere (Schmermund et al. 2002). Baseline examinations were performed between 2000 and 2003 and included 4,814 participants between 45 and 75 years old who were randomly selected from population registries. Individuals were eligible if their address was valid, they were not institutionalized, had sufficient knowledge of the German language, were not severely ill, and were able to be interviewed. In addition, pregnant women (although not a priority, given the investigated age group) and relatives of study personnel were excluded. The baseline response calculated as recruitment efficacy proportion was 55.8% (Stang et al. 2005). Follow-up examinations were performed between 2005 and 2008. Our analyzed sample is depicted in Figure 1 and is further described in the statistical analysis section of the "Methods." The study maintains extensive quality management procedures, including a certification according to Deutsches Institut für Normung (DIN) ISO 9001:2000/2008 (DIN 2000). The HNR was approved by the local ethics committees, and all participants gave informed consent prior to participation.

Outcome. Depressive symptoms during the previous week were assessed using the 15-item short-form questionnaire of the Center for Epidemiologic Studies Depression Scale (CES-D) (Hautzinger and Bailer 1993; Radloff 1977), which was distributed to participants at the baseline and 5-year follow-up visits at the study center (and was mailed to participants who did not attend the examinations). The CES-D is a screening tool for measuring depressive symptoms; it has been validated in different populations and settings and is frequently used in health research (Radloff 1977). Possible scores for the 15-item version range from 0 to 45, with higher levels indicating more and/or more frequent depressive symptoms. The CES-D is considered an indicator of a probable depressive episode but does not replace a face-to-face physician diagnosis. Antidepressant medication was also included in the outcome definition because it is indicative of depressive symptoms being treated (even if off-label use may occur) and may affect CES-D results in depressive individuals because treated participants may show fewer symptoms of depression. Assessment of all medication intake was performed by asking participants to bring all medication (including packages) taken in the previous 7 days to both the baseline and follow-up visits. Intake of antidepressant medication classified in the Anatomical Therapeutic Chemical (ATC) groups N06A or N06CA [WHO Collaboration Centre for Drug Statistics Methodology (WHOCC) 2011] and/or a CES-D score ≥ 17 according to Hautzinger and Bailer (1993) were used to define high depressive symptoms.

Exposure. Road traffic noise was modeled according to Directive 2002/49/EC of the European Parliament and Council of the European Union (2002) for the year 2006 as a weighted day–evening–night (24-hr) average sound level (L_{den}) in 5–A-weighted decibel [dB(A)] categories (isophones). The following factors were considered in the noise-level modeling: small-scale topography of the area, dimensions of buildings, noise barriers, street axis, vehicle type–specific traffic density, speed limit, and type of road surface. Noise exposure data were assigned to the geographic residence location of the study participant at baseline using the geographic information system ArcGIS, assuming average noise levels to be relatively stable over time. High noise exposure was defined as noise levels of L_{den} > 55 dB(A), based on the maximum community noise levels recommended by the WHO (Berglund et al. 1999). Data on nighttime noise (L_{night}, 2200–0600 hours) were available and were also analyzed, with nighttime noise levels > 50 db(A) defined as high noise exposure.

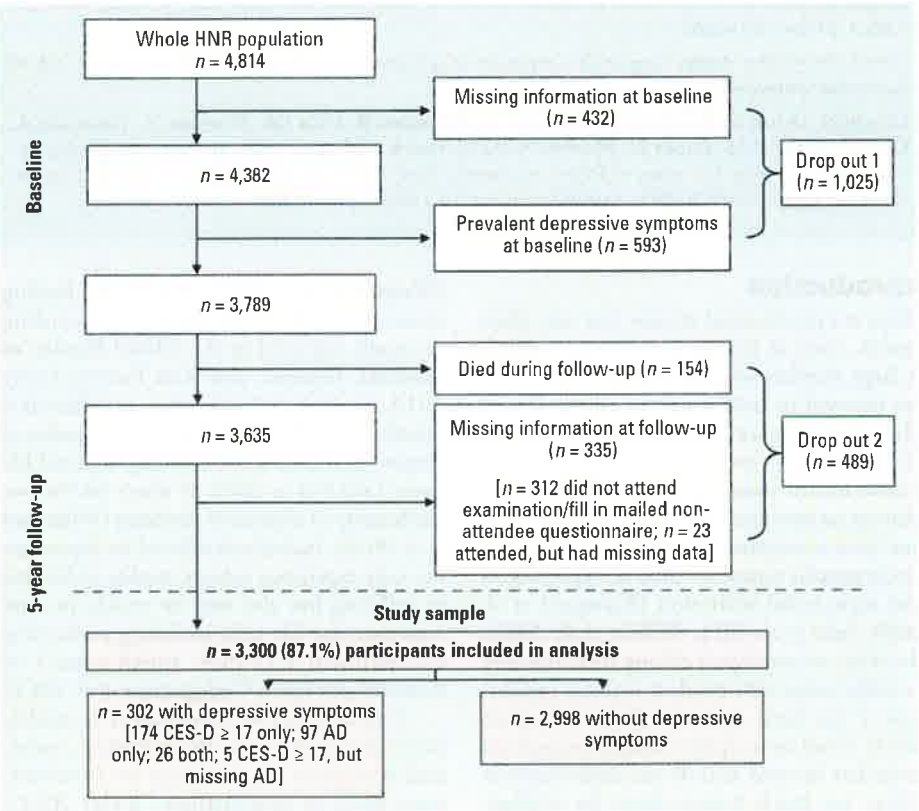

Figure 1. Flow chart of study participants in the Heinz Nixdorf Recall (HNR) study. Missing information = missing information on depressive symptoms [Center for Epidemiologic Studies Depression Scale (CES-D), antidepressant medication use (AD)]; prevalent depressive symptoms = CES-D ≥ 17 and/or antidepressant medication use.

Covariates. Socioeconomic (e.g., income), demographic (e.g., age), behavioral (e.g., smoking: current, former, or never smoker), and medical history data were assessed via standardized computer-assisted personal interviews at the baseline examination. Education, income, and economic activity were used as indicators of socioeconomic status (SES) (Shavers 2007; Galobardes et al. 2007). Education was defined by combining school and vocational training as total years of formal education, according to the International Standard Classification of Education (UNESCO 1997), and was categorized into four groups (≤ 10, 11–13, 14–17, and ≥ 18 years). Income was measured as the monthly household equivalent income, which was calculated by dividing the total household net income by a weighting factor for each household member, and was divided into four groups using sex-specific quartiles. Economic activity was categorized into three groups [employed, inactive (retired, homemaker, etc., but not unemployed), and unemployed]. Information on whether participants had/had ever had myocardial infarction, heart failure, stroke, diabetes mellitus, emphysema, asthma, cancer, rheumatism, slipped disc, or migraine (yes/no) at baseline was used to create a categorical variable indicating the number of comorbidities (0, 1, or ≥ 2). In addition, participants were asked to indicate if they had/had ever had depression. Insomnia was assessed based on three insomnia symptoms: difficulties falling asleep, difficulties maintaining asleep, and early morning arousals (Riedel et al. 2012). If participants reported that all of these symptoms were present at least two times per week during the previous 4 weeks, they were classified as having insomnia. One example of the three insomnia questions is "How often, during the last 4 weeks, did you have difficulties in falling asleep?" The possible answers were "never," "sometimes (one time per week or less)," "often (at least 2 times per week)," or "almost every night." Height and weight were obtained from standardized anthropogenic measurements performed during the clinical examination. The body mass index (BMI) was calculated as [weight in kilograms/(height in meters)^2].

We applied the 2001 unemployment rate in the respective city unit (German terms: in Essen, "Stadtteil"; in Bochum and Mülheim/Ruhr, "Statistischer Bezirk") as an indicator of neighborhood-level SES. These data were obtained from the local census authorities of the respective cities of Bochum, Essen, and Mülheim/Ruhr.

Residential distance to the nearest major road was calculated as a marker of traffic proximity using ArcGIS. A major road was defined as one falling into the upper quartile of mean daily traffic density (> 22,980 vehicles per day, year 2000). There was a weak negative correlation between traffic proximity and noise in our study (Pearson $r = -0.22$). We included this variable in the analysis to control for nonacoustic factors of traffic and the physical environment of the neighborhood (e.g., aesthetic aspects and perceived safety) that might affect mental wellbeing.

Statistical analyses. From the full HNR sample (n = 4,814), we excluded 432 participants with missing information on depressive symptoms (CES-D and/or antidepressant medication) and an additional 593 participants with prevalent high depressive symptoms at baseline (Figure 1). Of the remaining 3,789 participants, 154 died during follow-up, 312 were excluded because they did not attend the follow-up examination (when medication use and CES-D were assessed) or complete the mailed nonattendee follow-up questionnaire (including the CES-D), and 23 were excluded because they did not complete the CES-D and were not identified as using antidepressant medication at the follow-up visit (Figure 1). Five of the included participants did not attend the follow-up visit but were classified as having high depressive symptoms based on the mailed nonattendee follow-up CES-D. Thus, the final analysis sample included 3,300 participants (87.1% of the 3,789 eligible participants).

We used Poisson regression with a robust variance to estimate crude and adjusted effects of high road traffic noise on depressive symptoms after 5 years (Spiegelman and Hertzmark 2005; Zou 2004). The adjustment sets were selected *a priori* based on a directed acyclic graph (see Supplemental Material, Figure S1) created with DAGitty (Textor et al. 2011). In model 1, we adjusted for age (continuous), sex, education (four categories), income (quartiles), economic activity (three categories), neighborhood-level SES (unemployment rate, continuous) and traffic proximity (continuous). In Model 2, we additionally adjusted for the potential confounders BMI (continuous) and smoking, and in Model 3, the potential confounders/intermediates comorbidities (0, 1, or ≥ 2) and insomnia (yes/no) were added. Observations with any missing covariate data were automatically excluded from the respective analysis (complete case analysis). All analyses were also stratified by sex to investigate potential sex-specific differences. In addition to modeling road traffic noise as a binary variable [L_{den} > 55 vs. ≤ 55 dB(A)], we estimated associations with three noise exposure categories [L_{den} > 55 to ≤ 60 dB(A), > 60 to ≤ 65 dB(A), > 65 dB(A)] compared with the reference group that had L_{den} ≤ 55 dB(A) noise exposure.

We conducted exploratory analyses by stratifying the participants by *a*) education level (≤ 13 vs. > 13 years of formal education), *b*) movers versus nonmovers between the baseline and 5-year follow-up visits, *c*) insomnia (yes/no), and *d*) city of residence. Further sensitivity analyses were conducted by *e*) additionally excluding participants who reported to have/ever have had depression at baseline, *f*) using a cutoff of L_{den} > 65 dB(A) to define very high noise exposure, *g*) using CES-D score ≥ 17 exclusively to define high depressive symptoms at baseline and follow-up, and *h*) using antidepressant medication intake exclusively to define high depressive symptoms at baseline and at follow-up.

All analyses were conducted with SAS v.9.4 (SAS Institute Inc.).

Results

Baseline characteristics of the analyzed population by noise exposure are shown in Table 1. Participants with high and low noise exposure were similar regarding sex and mean age, whereas proportions of insomnia, low education, low income, unemployment, and active smoking were higher in participants exposed to high noise levels. Only a small amount of covariate data were missing (maximum 15, for insomnia), with the exception of the income variable, for which a total of 196 values were missing (Table 1). Additionally, 605 values were missing for the variable indicating reported (lifetime) prevalence of depression, which was applied in one of the sensitivity analyses. At follow-up (5.1 years after baseline, on average), 302 participants [9.2%, including 201/1,585 women (12.7%) and 101/1,715 men (5.9%)] were classified as having high depressive symptoms based on a CES-D score ≥ 17 (n = 179), use of antidepressant medication (n = 97), or both (n = 26) in the previous week (Figure 1). Participants who were excluded from the analysis because of depressive symptoms/missing depressive symptoms data at baseline (drop out 1), or death or missing outcome data at follow-up (drop out 2), were similar to the analysis sample with regard to sex, age, and other baseline characteristics (see Supplemental Material, Table S1). However, they were more likely to have been current smokers (26–31% vs. 20–24%), and they had more comorbidities (36–37% vs. 29–31% with ≥ 2), lower education (19% vs. 8–9% with ≤ 10 years), and lower income (33–34% vs. 21–27% in the lowest quartile) than participants who were included in the analysis. Participants excluded because of prevalent depressive symptoms at baseline/missing depressive symptoms data were more likely to have reported insomnia at baseline (22% vs. 8–11%) and were less likely to be male (40% vs. 52%) than those who were included.

Of the included study population, 35.7% (n = 1,179) were exposed to high 24-hr traffic noise levels [L_{den} > 55 dB(A)], and 25.8% (n = 850) were exposed to high traffic noise

at night [L_{night} > 50 dB(A)]. Distributions of annual mean noise exposures (overall and at night) were positively skewed (see Supplemental Material, Figure S2).

The results of the regression analysis (Table 2) revealed an adjusted RR (Model 1) of 1.29 (95% CI: 1.03, 1.62) for high depressive symptoms at follow-up in participants exposed to high noise levels compared with the low-noise exposure group. Estimates for men and women combined were similar for Models 2 and 3 and the unadjusted estimate (Table 2). Unadjusted associations were stronger for men than for women but were similar between men and women after adjustment for sociodemographic covariates (Model 1) and BMI and smoking (Model 2). Adjusting for potential intermediates (comorbidities and insomnia, Model 3) slightly reduced the RR toward the null for men but did not influence the association for women. We excluded participants with missing income data (n = 196), which produced no substantial influence on the results, yielding a crude total RR of 1.39 (95% CI: 1.11, 1.74; n = 3,104) and an RR of 1.43 (95% CI: 0.97, 2.10; n = 1,652) in men and an RR of 1.36 (95% CI: 1.03, 1.78; n = 1,452) in women (data not shown in Table 2). In general, associations between depression and exposure to noise at night [L_{night} > 50 vs. ≤ 50 dB(A)] were similar to associations with average 24-hr noise exposure (Model 1 RR = 1.29; 95% CI: 1.01, 1.64 for men and women combined), although associations were weaker for men (RR = 1.19; 95% CI: 0.77, 1.82) than for women (RR = 1.36; 95% CI: 1.01, 1.82) (see Supplemental Material, Table S2).

Associations between noise and depressive symptoms did not increase with increasing noise when exposure was categorized into four groups (Figure 2). When compared with the ≤ 55 dB(A) category, the association was strongest for the middle exposure category [> 60 to ≤ 65 dB(A), RR = 1.52; 95% CI: 1.11, 2.07] and equally weaker for the highest and lowest exposure groups (RR = 1.19; 95% CI: 0.85, 1.68 and RR = 1.19; 95% CI: 0.86, 1.65, respectively) (Figure 2). Similarly, there was no evidence of a monotonic dose–response relationship for nighttime road traffic noise, but the pattern differed: the middle exposure category [> 55 to ≤ 60 dB(A)] had the weakest association compared with the ≤ 50 dB(A) reference

Table 1. Characteristics of the analyzed Heinz Nixdorf Recall study population (n = 3,300), by 24-hr road traffic noise.

Characteristic	L_{den} > 55 dB(A)	L_{den} ≤ 55 dB(A)
	n (percent), mean ± SD, or median (Q1, Q3)	n (percent), mean ± SD, or median (Q1, Q3)
Baseline		
n (percent)	1,179 (35.7)	2,121 (64.3)
Men	610 (51.7)	1,105 (52.1)
Age (years)	59.1 ± 7.7	59.3 ± 7.6
Insomnia	124 (10.5)	177 (8.4)
Missing (n)	3	12
Number of comorbidities[a]		
0	440 (37.3)	830 (39.1)
1	374 (31.7)	687 (32.4)
≥ 2	365 (31.0)	604 (28.5)
Reported (lifetime) prevalence of depression	70 (7.3)	106 (6.1)
Missing (n)	225	380
Body mass index	27.9 ± 4.7	27.7 ± 4.5
Missing (n)	6	4
Smoking		
Current	288 (24.4)	423 (19.9)
Former	419 (35.5)	778 (36.7)
Never	472 (40.0)	920 (43.4)
Distance to nearest major road (meters)	532.4 (220.0,1083.1)	987.7 (552.8,1620.7)
Missing (n)	0	5
Unemployed in neighborhood (percent)	12.8 ± 3.3	12.0 ± 3.3
Education (years)[b]		
≤ 10	111 (9.4)	165 (7.8)
11–13	703 (59.6)	1,135 (53.5)
14–17	251 (21.3)	525 (24.8)
≥ 18	114 (9.7)	295 (13.9)
Missing (n)	0	1
Household net income		
Quartile 1 (low)	300 (27.0)	420 (21.1)
Quartile 2	257 (23.1)	473 (23.8)
Quartile 3	290 (26.1)	502 (25.2)
Quartile 4 (high)	266 (23.9)	596 (29.9)
Missing (n)	66	130
Economic activity		
Employed	503 (42.7)	937 (44.2)
Inactive	591 (50.2)	1,078 (50.8)
Unemployed	84 (7.1)	106 (5.0)
Missing (n)	1	0
City of residence		
Mülheim/Ruhr	467 (39.6)	772 (36.4)
Bochum	334 (28.3)	654 (30.8)
Essen	378 (32.1)	695 (32.8)
Follow-up		
CES-D ≥ 17 and/or antidepressant medication	127 (10.8)	175 (8.3)
CES-D ≥ 17	89 (7.6)	116 (5.5)
Antidepressant medication	56 (4.8)	67 (3.2)
Missing (n)[c]	2	3
Moved between baseline and follow-up		
Yes	214 (18.2)	314 (14.8)
No	965 (81.9)	1,807 (85.2)

Abbreviations: CES-D, Center for Epidemiologic Studies Depression Scale; dB(A), A-weighted decibels; L_{den}, average annual 24-hour noise level; Q1, quartile 1 (25th percentile); Q3, quartile 3 (75th percentile).
[a]Of the following: myocardial infarction, heart failure, stroke, diabetes, emphysema, asthma, cancer, rheumatism, slipped disc, migraine. [b]Combines school and vocational training. [c]These participants were identified as having high depressive symptoms by CES-D and were therefore included.

Table 2. Relative risks (with 95% confidence intervals) of high depressive symptoms at follow-up in study participants exposed to residential road traffic noise (L_{den}) > 55 dB(A) and L_{den} ≤ 55 dB(A).

Model	Cases (n)	Total (n)[a]	RR (95% CI)
Unadjusted			
Total	302	3,300	1.31 (1.05, 1.62)
Men	101	1,715	1.46 (1.00, 2.13)
Women	201	1,585	1.23 (0.95, 1.60)
Model 1[b]			
Total	279	3,098	1.29 (1.03, 1.62)
Men	98	1,650	1.29 (0.87, 1.92)
Women	181	1,448	1.30 (0.98, 1.72)
Model 2[c]			
Total	278	3,089	1.28 (1.02, 1.61)
Men	98	1,644	1.28 (0.85, 1.94)
Women	180	1,445	1.28 (0.97, 1.69)
Model 3[d]			
Total	276	3,075	1.26 (1.00, 1.58)
Men	97	1,637	1.21 (0.81, 1.82)
Women	179	1,438	1.28 (0.97, 1.70)

Abbreviations: CI, confidence interval; dB(A), A-weighted decibels; RR, relative risk.
[a]Numbers in Models 1-3 differing from the unadjusted model reflect missing covariate data. [b]Adjusted for age, sex (except in the sex-stratified analysis), education, income, economic activity, neighborhood-level socioeconomic status, traffic proximity. [c]Additionally adjusted for body mass index, smoking. [d]Additionally adjusted for comorbidities, insomnia.

group (RR = 1.14; 95% CI: 0.78, 1.65) (see Supplemental Material, Figure S3).

Table 3 shows the results of additional analyses. We estimated a positive association between noise exposure and high depressive symptoms at follow-up among 2,115 participants with ≤ 13 years of education (Model 1 RR = 1.43; 95% CI: 1.10, 1.85), in contrast with a weak negative association among 1,185 participants with > 13 years of education (RR = 0.92; 95% CI: 0.56, 1.53). A higher effect estimate was found in the subgroup with insomnia at baseline (Model 1 RR = 1.62; 95% CI: 1.01, 2.59; n = 281) than in those without insomnia at baseline (RR 1.21; 95% CI: 0.94, 1.57; n = 2,803) (Table 3). The association between traffic noise and depressive symptoms did not change remarkably when excluding participants who reported to have/ever have had depression at baseline (n = 176) or had missing data on depression (n = 605), yielding an RR of 1.24 (95% CI: 0.97, 1.59; Model 1). Using a higher cutoff value for defining high noise exposure [L_{den} > 65 vs. ≤ 65 dB(A)] resulted in an RR of 1.07 (95% CI: 0.77, 1.49), which is in accord with the results shown in Figure 2. Using either only a CES-D score ≥ 17 (n = 244 cases at follow-up) or only intake of antidepressant medication (n = 157 cases at follow-up) to define the outcome did not produce results that were different from those obtained with the combined outcome definition (Table 3). In general, additional analyses for the association of nighttime traffic noise exposure > 50 dB(A) versus ≤ 50 dB(A) with high depressive symptoms at follow-up showed similar results to those for 24-hr noise exposure, with the possible exception of the analysis that used antidepressant medication use to define outcome (see Supplemental Material, Table S3).

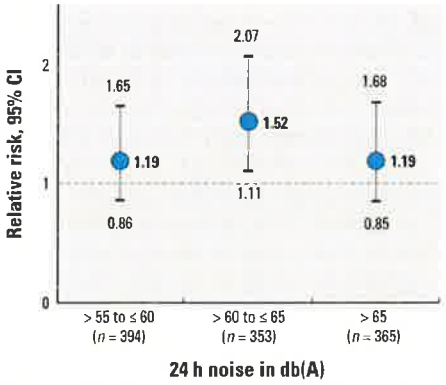

Figure 2. Relative risks and 95% confidence intervals of high depressive symptoms at follow-up in association with exposure to different categories of 24-hr noise compared with the lowest noise category [≤ 55 dB(A); n = 1,986], adjusted for baseline age, sex, education, income, economic activity, neighborhood-level socioeconomic status, and traffic proximity (Model 1). dB(A), A-weighted decibels.

Discussion

Our prospective study provides support for the hypothesis that long-term exposure to road traffic noise may increase the risk of depressive symptoms.

In our study population as a whole, high depressive symptoms at follow-up were ~25–30% more frequent in study participants exposed to road traffic noise levels > 55 dB(A) than in participants exposed to noise levels ≤ 55 dB(A). The association remained stable after adjustment for various covariates, highlighting the robustness of the results when considering potential confounding factors. Our findings are in line with results from previous cross-sectional studies on road traffic noise and depression. A study conducted in Serbia (Stošić and Blagojević 2011) with 911 participants between 18 and 80 years old found that participants living in a noisy city area of Niš [daily period noise ≥ 55 dB(A) and night noise ≥ 45 dB(A)] reported "feeling depressed" more frequently than the control participants, who lived in two quiet city areas [daily period noise ≤ 55 dB(A) and night noise ≤ 45 dB(A)]. A similar small Swedish study compared 151 persons who lived in a quiet city area with 97 persons who lived in an area exposed to noise (Öhrström 1991). The study used mailed questionnaires to assess psychosocial wellbeing, including depression, and the authors found that people living in the noisy area felt depressed more often. In another questionnaire-based study of 366 women (20–60 years old) living in Tokyo (Yoshida et al. 1997), an unadjusted OR of 2.9 (p < 0.05) for high responses to depression-related questions was found for women exposed to residential road traffic noise levels > 70 dB(A) compared with those exposed to 45 to ≤ 70 dB(A). Importantly, none of these cross-sectional studies reported controlling for potential confounding factors. Sygna et al. (2014) found an association (controlled for confounders) between road traffic noise and psychological distress, including depressive symptoms, but only in a subgroup of 274 participants with low sleep quality (OR 1.40, 95% CI: 0.99, 1.98; per 10-dB increase). To our knowledge, the Caerphilly study (Stansfeld et al. 1996) is the only previous prospective study of traffic noise and depressive symptoms; in this study, the authors analyzed data from 1,725 men living in Caerphilly, South Wales (50–64 years old). This men-only study found no association between traffic noise levels at baseline [in four 5-dB(A) categories ranging from 51–55 dB(A) to 66–70 dB(A)] and mean depression scores from the general health questionnaire at the 5-year follow-up, adjusting for age, social class, noise sensitivity, and depressive symptoms at baseline (n = 1,587). However, the study did find an association with mean anxiety scores, which significantly differed across the noise categories (p for heterogeneity = 0.03, n = 1,584) (Stansfeld et al. 1996). In summary, most previous studies on road traffic noise and depressive symptoms found an association, and our study adds to the existing body of evidence by prospectively analyzing a comprehensive cohort including both men and women while at the same time accounting for potential confounding factors.

Sex-specific analyses revealed no differences between men and women. It is notable,

Table 3. Results of the sensitivity analyses, showing relative risks (with 95% confidence intervals) of high depressive symptoms at follow-up in study participants exposed to residential road traffic noise (L_{den}) > 50 dB(A) and ≤ 50 dB(A).

Subgroup	Cases (n)	Total (n)[a]	RR (95% CI)[b]
Education			
≤ 13 years	214	1,968	1.43 (1.10, 1.85)
> 13 years	65	1,130	0.92 (0.56, 1.53)
Moved during follow-up			
Yes	61	502	1.17 (0.72, 1.88)
No	218	2,596	1.33 (1.02, 1.72)
Insomnia			
Yes	55	281	1.62 (1.01, 2.59)
No	222	2,803	1.21 (0.94, 1.57)
City of residence			
Mülheim/Ruhr	99	1,162	1.21 (0.83, 1.76)
Bochum	89	927	1.51 (1.00, 2.29)
Essen	91	1,009	1.16 (0.77, 1.74)
Excluded lifetime prevalence of depression at baseline[c]	189	2,382	1.34 (1.01, 1.76)
Noise cutoff L_{den} > 65 dB(A)	279	3,098	1.07 (0.77, 1.49)
CES-D ≥ 17 only to define outcome	227	3,469	1.24 (0.96, 1.61)
Antidepressant medication only to define outcome	144	3,467	1.28 (0.92, 1.80)

Abbreviations: CES-D, Center for Epidemiologic Studies Depression Scale; CI, confidence interval; dB(A), A-weighted decibels; RR, relative risk.
[a]Maximum total n in Model 1 = 3,098; numbers differing from those in Table 1 reflect missing covariate data (in Model 1). [b]Adjusted for age, sex, education (not in the education-stratified analysis), income, economic activity, neighborhood-level socioeconomic status, and traffic proximity (Model 1). No substantial differences were observed in unadjusted results and in results for Model 2 and Model 3 (data not shown). [c]Excluded 176 participants who reported having/having ever had depression and 605 participants with missing data.

however, that high depressive symptoms at follow-up were far more common in women than in men (12.7% vs. 5.9%). This result is consistent with existing epidemiologic research, where a higher prevalence of depression has been observed in women than in men, with an estimated female:male ratio of 2.3 (Wittchen et al. 2011). It has been argued that these differences in prevalence may not be real because depression symptoms may vary between men and women (Azorin et al. 2014; Rutz 1999; Schuch et al. 2014), but commonly applied diagnostic criteria focus on symptoms that are rather typical for women, and men are believed to display less pronounced help-seeking behavior than women (Piccinelli and Wilkinson 2000; Schuch et al. 2014). Thus, a potential for measurement error caused by sex-insensitive diagnostic criteria and varying prescribing patterns must be considered, and sex-specific associations deserve further attention.

When investigating different categories of road traffic noise, RRs did not increase linearly with increasing noise levels, and we found that elevated risks of high depressive symptoms were strongest not in the highest exposure group but in the intermediate exposure group for 24-hr noise exposure. However, the number of participants in the noise categories was small, the overall incidence of depressive symptoms was low, and we consider this analysis primarily exploratory for future research aims. Previous studies also failed to identify a linear trend (Stansfeld et al. 1996; Yoshida et al. 1997). An explanation for this missing dose–response relationship may be that measures for noise mitigation (e.g., noise protection windows) and behavioral prevention (i.e., closed windows, choice of quiet sleeping room, earplugs) may be more common in areas with very high noise exposure. A nonlinear relationship of exposure and outcome may also contribute to the inconsistency among the results from previous studies.

We found a strong association of traffic noise with high depressive symptoms in less-educated participants and a weak negative association in highly educated participants (Table 3). Furthermore, a high proportion of study participants with low incomes and low education and who were unemployed had high traffic-noise exposure (Table 1), supporting previous observations of a socially inequitable distribution of environmental burden (Braubach and Fairburn 2010). A previous analysis performed by the German Socio-Economic Panel found that low household income was associated with high perceived noise exposure (Kohlhuber et al. 2006).

The association of noise with depression-related outcomes that was observed in the HNR and in previous studies seems to be biologically plausible. Stratified analyses in the present study revealed a strong association between high noise exposure and high depressive symptoms in participants with insomnia at baseline, and the same was found in a previous study (Sygna et al. 2014). This finding is in line with the hypothesis of impaired sleep as a possible pathway for developing depressive symptoms (Baglioni et al. 2011). However, insomnia may also be a symptom of depression rather than a contributing factor; thus, an association between depression and insomnia at the same point in time may be bidirectional. Our results suggest that individuals with preexisting sleep disturbances might have increased vulnerability to the effects of noise on depressive symptoms. However, we do not know the underlying causes of insomnia in our study population.

Another factor linking noise and depression may be noise-induced stress reactions of the body. Acute noise stimuli cause the central nervous system to initiate warning/alert reflexes that are beyond individual control and that affect a number of bodily functions, such as muscle tension and pulse rate (Rylander 2004). Repeated exposure to noise for long periods is typically considered unpleasant or annoying when it interferes with activities of living such as communication, tasks that require concentration, or recreational activities such as sleep and rest. Habituation to noise rarely occurs, and chronic exposure to noise that causes negative physiological stress reactions may lead to a stage where acute effects, such as increased blood pressure, become permanent (Rylander 2004). Furthermore, it has been noted that exposure to stressors promotes neurochemical and endocrine changes that may be involved in the provocation of depressive disorder (Anisman and Merali 2002; Wager-Smith and Markou 2011). Chronic stress caused by noise exposure may lead to involuntary defeat reactions characterized by, for example, decreased motor function, reduced secretion of cortisol and adrenaline, and suppression of the immune system, with depression of mood a possible consequence. However, the extent to which noise causes such defeat reactions may differ among individuals depending on the ability to escape noise by, for example, closing the windows or choosing a bedroom facing away from the street (Rylander 2004). Increased stress hormone levels caused by noise are a frequent finding (Ising and Kruppa 2004) and may explain our observed results when we considered physiological stress as a factor in the pathway from noise exposure to depression. It is also possible that the observed association of noise with depressive symptoms is in part mediated by other stress-related or chronic diseases such as cardiovascular disease, which has been found to be associated with both noise and depression (Münzel et al. 2014; Hare et al. 2014); however, accounting for comorbidities by adjustment did not change the RR estimate in our study.

Strengths of this study include a high-quality noise exposure model and residential addresses obtained at baseline to accurately assess exposure. Depressive symptoms were assessed by a widely used and well-established instrument. The prospective design allowed investigation of long-term noise effects, assuming that the mean noise levels modeled for 2006 and assigned to the baseline (2000–2003) residence location were constant over the 5-year follow-up period. We were able to investigate a large number of randomly selected participants, allowing noise effects to be studied in different subgroups. Furthermore, comprehensive measurements enabled inclusion of many potential confounding factors in our analyses.

With regard to study limitations, exposure misclassification is a major concern in environmental epidemiology. Noise exposure assessment in the present study included residential road traffic noise only; other sources of residential noise, such as air or railway traffic noise or noise caused by neighbors, were not included. Nevertheless, road traffic is considered the major source of noise pollution in urban metropolitan contexts such as the investigated Ruhr area (Omidvari and Nouri 2009), and most of the neighborhoods included in our study population were not affected by aircraft noise. Furthermore, we had no information on time spent at the residence or on nonresidential noise exposures such as occupational noise. Individual characteristics such as room ventilation patterns, hearing ability, and noise protection windows were not accounted for in the analysis but may also have contributed to misclassification of noise exposure. Participants with (very) high levels of noise exposure may make more use of noise-avoidance strategies, which may lead to an underestimation of the effect that would be observed without these measures. This may in part explain our findings of a lower RR in the highest noise category. Participants exposed to high and low levels of noise may differ in some characteristics relevant to the development of depressive symptoms, and although we were able to take a range of these factors into account in our analyses, unknown confounding cannot be ruled out. Additional bias caused by missing data is possible; however, income information was the most commonly missing data, yet excluding those missing data from the crude model did not change the results. Potential air pollution effects were only accounted for indirectly by adjusting for traffic proximity. Modeling the average noise level, as we did here, does not reflect potential peaks, extreme

noise events, or single sleep-disturbing noise events in otherwise quiet areas, all of which are of special relevance in terms of physiological stress reactions to noise (Rylander 2004; Babisch 2002). In addition, noise was modeled for the year 2006, and the assumption of unchanged noise exposure during the study period may not hold. The severity and presence of depressive symptoms vary over time; therefore, additional CES-D assessments (e.g., yearly instead of every 5 years) would have allowed for a more precise outcome measurement. We investigated a general population sample of middle-aged and older men and women living in a German metropolitan area; hence, our results cannot be generalized to populations from other countries, to children or young adults, or to populations residing in rural areas.

Conclusion

Our results suggest that exposure to residential traffic noise may increase the risk of high depressive symptoms in middle-aged and older adults. Additionally, our study offers preliminary evidence that those with low socioeconomic status and those who experience sleep disturbances may be particularly vulnerable to noise effects. Further prospective research is needed to confirm the results of our study and to extend the generalizability of our findings to other populations. Studies including measures of stress and subjective noise annoyance may also extend our knowledge into the mechanisms of noise-induced depression. However, there is already evidence of adverse health effects arising from noise exposure, stressing the necessity of protecting populations from noise pollution; this is particularly important with regard to environmental justice because our results indicate that traffic noise may be unequally distributed across social strata.

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Suicide and Transportation Noise: A Prospective Cohort Study from Switzerland

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Background: Although plausible from a pathophysiological point of view, robust evidence for effects of transportation noise on mental health remains scarce. Meanwhile, psychiatric diseases are among the most prevalent noncommunicable diseases worldwide, and suicide as a mortality outcome highly connected to mental disorders presents a pressing public health issue. The aim of this study was to investigate the association between source-specific transportation noise, particulate matter (PM) air pollution, residential greenness, and suicide by means of a nationwide cohort study.

Methods: Road traffic, railway and aircraft noise exposure as well as exposure to air pollution [PM with aerodynamic diameter ≤ 2.5 μm ($PM_{2.5}$)] and greenness [normalized difference vegetation index (NDVI)] were linked to 5.1 million adults (age 15 y and older) in the Swiss National Cohort, accounting for their address history. Mean noise exposure in 5-y periods was calculated. Individuals were followed for up to 15 y (2001–2015). Time-varying Cox regression models were applied to deaths by suicide (excluding assisted suicide). Models included all three noise sources, $PM_{2.5}$, and NDVI plus individual and spatial covariates, including socioeconomic status. Effect modification by sex, age, socioeconomic indicators, and degree of urbanization was explored.

Results: During the follow-up, there were 11,265 suicide deaths (10.4% poisoning, 33.3% hanging, 28.7% firearms, 14.7% falls). Road traffic and railway noise were associated with total suicides [hazard ratios: 1.040; 95% confidence interval (CI): 1.015, 1.065; and 1.022 (95% CI: 1.004, 1.041) per 10 dB day-evening-night level (Lden)], whereas for aircraft noise, a risk increase starting from 50 dB was masked by an inverse association in the very low exposure range (30–40 dB). Associations were stronger for females than males. The results were robust to adjustment for residential greenness and air pollution.

Conclusion: In this longitudinal, nationwide cohort study, we report a robust association between exposure to road traffic and railway noise and risk of death by suicide after adjusting for exposure to air pollution and greenness. These findings add to the growing body of evidence that mental health disorders may be related to chronic transportation noise exposure. https://doi.org/10.1289/EHP11587

Introduction

Mental health disorders represent a pressing public health issue. In 2019, the prevalence of mental health disorders globally was estimated to be 13% [95% confidence interval (CI): 12.1, 14.0%], which translates to almost 1 billion people affected. In Switzerland, the estimated prevalence was slightly higher with 17.3% (95% CI: 15.9, 18.8%), translating to about 1.4 million people affected.[1] Although most mental health disorders primarily lead to morbidity and decreased quality of life, a mortality outcome closely related to mental illness is suicide.[2,3] Suicide is a complex, multicausal phenomenon, involving psychological, social, biological, and environmental factors. A study on suicide in the Swiss National Cohort confirmed that mental and behavioral problems were by far the most prevalent comorbidities in suicide victims across all professions, age groups, and genders.[4] Only recently research has started to also explore and identify possible environmental risk factors for suicide, with reported associations of an increased suicide risk with heat,[5] air pollution,[6] and noise.[7] On the other hand, residential greenness and urban green space have been recognized as environmental factors with protective properties.[8] Although suicide rates have decreased worldwide and in Switzerland in the last 20 y, the decline is not yet on course to reach the Sustainable Development Goal (SDG) aim of a reduction by one-third by 2030. The World Health Organization (WHO) report, "Suicide Worldwide in 2019," published in 2021, estimated that 703,000 people died from suicide in 2019 worldwide, which corresponds to 1.3% of all yearly deaths.[9] On the grounds of such numbers, reducing the occurrence of mental illnesses is a primary public health interest. Hence, understanding risk factors for the development of mental disorders and therefore for suicide is of utmost importance. In light of the growing urbanization worldwide, studying the role of urban environmental stressors as such potential risk factors can potentially yield insights of consequential importance concerning the promotion of mental health and prevention of psychiatric morbidity and mortality.

In recent years, noise has been recognized as one of the most impactful environmental stressors on health and well-being.[10] Among the sources of environmental noise, transportation noise and especially road traffic noise have emerged as the most prevalent and harmful. According to a European Environmental Agency (EEA) report, 20% of the European population (139 million people) in 2017 were estimated to live in areas with transportation noise levels that are considered harmful [>55 dB day-evening-night level (Lden)].[10] A more recent study investigating noise exposure in 700 cities in Europe estimated that 42% of the adult urban population are exposed to such harmful levels.[11] Due to this widespread occurrence, noise is the second most important driver of the environmental burden of disease in Europe, behind fine particulate matter (PM) air pollution. In numbers, exposure to transportation noise is estimated to be responsible for 400–1,500 disability adjusted life years lost each year per million people in Western Europe.[12] However, because more evidence including more outcomes has emerged since 2014, and, for example, effects on mental health were not included in the above-

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mentioned calculations, these numbers might actually represent an underestimation.

Concerning negative health effects related to noise exposure, there is growing evidence for diverse nonauditory effects, such as arterial hypertension, cardiovascular and metabolic diseases such as type 2 diabetes,[13–16] sleep disturbance,[17] annoyance,[18] as well as reduced quality of life and well-being[19]—and mental health and neurological disorders.[20] Although the exact pathways of the influences of noise on health remain somewhat unclear, there is evidence that noise causes physiological stress reactions involving heightened amygdalar activity,[21] allostatic overload,[13,15] and disturbed sleep.[22] Because these are all established risk factors for multiple mental health disorders, including depression,[23–27] an association of noise with poor mental health seems plausible from a pathophysiological perspective. However, the systematic review on noise-related mental health outcomes used for the 2018 WHO guidelines resulted in a judgment of very low-quality evidence for aircraft noise effects on depression and anxiety and a judgment of low-quality evidence for a null effect of road traffic or railway noise.[28] The review included 29 predominantly cross-sectional studies. Hence, the poor quality of evidence was attributed to a lack of robust studies investigating the mental health effects of different noise sources. A more recent meta-analysis of five studies found an increased risk of 12% (95% CI: 2%, 23%) for depression per 10 dB Lden of aircraft noise exposure.[29] The same study[29] also suggested a 2%–3% increased risk for depression per 10 dB Lden for railway noise based on three studies and for road traffic noise based on eleven studies. Another review and meta-analysis including nine studies showed an association between transportation noise and anxiety [odds ratio (OR) = 1.09; 95% CI: 0.97, 1.23 per 10 dB], while also rating the quality of evidence as low.[30] Since the publication of this meta-analysis, a Swiss prospective cohort study (SAPALDIA) reported a 7% increased risk for the incidence of depression per 10 dB Lden road traffic noise [relative risk (RR) = 1.07; 95% CI: 0.93, 1.22] and a 20% increased risk per 10 dB Lden aircraft noise (RR = 1.20; 95% CI: 0.92, 1.55). So far, only one study investigating the associations between long-term exposure to environmental noise and suicide has been conducted.[7] The authors examined the risk for death by suicide in relation to average nighttime noise exposure (including noise caused by transportation and industrial and recreational activities) in adults in Korea and reported an increased risk per interquartile range (IQR = 2.67 dB) of nighttime noise of 32% (95% CI: 2%, 70%) in younger adults and 43% (95% CI: 1%, 102%) in older adults. A time-series study from Spain investigating short-term effects of traffic noise exposure on suicides and emergency admission for depression and anxiety reported an increased risk for both outcomes.[31]

In comparison, the effects of air pollution on mental health have received more attention and have been studied more thoroughly. Air pollutants have been shown to cause oxidative stress and neuroinflammation and to trigger stress responses with stress hormone release, which are the major hypothesized mechanisms linking air pollution and adverse mental health outcomes.[32,33] A systematic review and meta-analysis published in 2022 including 39 studies reported significant associations between long-term exposure to various air pollutants ($PM_{2.5}$, NO_2, SO_2, CO) and risk of depression. The largest risk increase was observed for PM with aerodynamic diameter ≤ 10 μm (PM_{10}) [RR = 1.092 (95% CI: 0.988, 1.206) per 10-$\mu g/m^3$ increase in exposure]. Smaller effects were also reported per 10-$\mu g/m^3$ increase of short-term exposure to $PM_{2.5}$ [RR = 1.009 (95% CI: 1.007, 1.011)], PM_{10} [RR = 1.009 (95% CI: 1.006, 1.012)], O_3 [RR = 1.011 (95% CI: 0.997, 1.026)], NO_2 [RR = 1.022 (95% CI: 1.012, 1.033)] and SO_2 [RR = 1.024 (95% CI: 1.010, 1.037)].[34] Another systematic review and meta-analysis from 2019 found similar results for depression, and also reported associations between short-term PM_{10} exposure and suicide risk [RR = 1.02 (95% CI: 1.00, 1.03) per 10 $\mu g/m^3$ at lag 0–2 d, including four studies].[6] These results were compiled in a more recent systematic review and meta-analysis from 2021 that included 10 studies, reporting a 2% (95% CI: 1%, 3%) risk increase for suicide per 10 $\mu g/m^3$ $PM_{2.5}$ exposure.[35] One limitation of these reviews is that most of the included studies have not adjusted for exposure to possible confounders such as transportation noise. A recent large cross-sectional study from the UK Biobank studying $PM_{2.5}$ and road traffic noise exposure, however, reported an increased risk for depression associated with $PM_{2.5}$ exposure, but no association with road traffic noise exposure was found.[36]

Residential greenness or green space is another exposure of interest in environmental epidemiology as a protective factor for health and well-being. For example, higher levels of greenness [normalized difference vegetation index (NDVI)] around people's place of residence have been associated with a lower risk of natural-cause mortality [HR = 0.94 (95% CI: 0.93, 0.95) per IQR (0.14 NDVI in a 500-m buffer)] in a large Swiss cohort study.[37] Concerning mental health, a Dutch study found a decreased risk for death by suicide in communities with high green space proportion (>85%) in comparison with communities with little (<25%) green space [RR = 0.879 (95% CI: 0.779, 0.991)].[38] Beyond suicide, a systematic review from 2020 suggested several beneficial effects of access to green space on adolescents' mental health, including fewer depressive symptoms and improved general mental health.[39] Multiple pathways are posited for this positive association, including that greener living environments or green space availability encourage healthy behavior, and that such factors can aid in stress relief.[40]

This study investigates the association between exposure to road traffic, railway, and aircraft noise and the risk of death by suicide in a longitudinal, nationwide research cohort in Switzerland. We hypothesized that people exposed to higher levels of transportation noise are more likely to develop mental health disorders such as depression and therefore have a higher risk of death by suicide, independent of coexposure to air pollution and residential greenness as well as socioeconomic position. By using suicide as a surrogate, we aimed to add to the understanding of whether transportation noise exposure affects mental health.

Methods

Study Population

The Swiss National Cohort (SNC) is a longitudinal, population-based research cohort. It links births, mortality, and emigration registries with the former national decennial census and, since 2010, with the annual Registry Based Census.[41,42] The linkages in the SNC from 2010 onward are deterministic using a personal identifier, whereas earlier linkages were performed probabilistically based on variables such as date of birth, sex, civil status, nationality, religion, and place of residence. No validation of the probabilistic linkage is available, but comparison with the deterministic linkages from 2010 and onward allows the discovery and exclusion of mismatches. Close to complete representation of the whole population is ensured by compulsory census participation, which is reflected in 98.6% of the population being included in the 4 December 2000 census.[43] The SNC was approved by the ethics committees of the Cantons of Zurich and Berne.

For the current study, we used the SNC as a closed cohort that included data from 1 January 2001 to 31 December 2015 for a total of 7.28 million individuals. After excluding individuals

below 15 y of age at baseline (17.5% of the full population), data with a mismatch between probabilistic and deterministic SNC linkage (i.e., incorrect probabilistic linkage, 8.2%), missing residential coordinates or individuals living in an institution (5.4%), missing information on covariates (i.e., education or socioeconomic position) (2.5%), or missing exposure data (0.2%), the final sample used for analysis consisted of 5.1 million observations (See Supplement Table S1). No imputations were performed.

Outcome

The outcome of interest was defined as all intentional self-harm [i.e., total suicides; *International Statistical Classification of Diseases and Related Health Problems, 10th Revision* (ICD-10): X60–84, excluding X61.8, X61.9, and X81–82] as cause of death. The SNC contains records from all deaths occurring in Switzerland from 1991 up to 2019 that included cause of death as ICD codes. Regarding exclusions, ICD-Codes X61.8 (right-to-die organization on death certificate) and X61.9 (Poisoning with pentobarbital; the drug used by right-to-die organizations) have been used to indicate assisted suicide since 1998.[44] Additionally, we suspected suicides involving vehicles (ICD-10: X81–82) to be spuriously associated with railway noise, due to confounding by proximity and therefore availability of the method. Because preliminary analysis confirmed this suspicion (see Figure S1), these outcomes were also excluded from the main analysis. The specific suicide subclasses Poisoning (ICD10: X60–69, excluding X61.8 and X61.9), Hanging (ICD-10: X70), Firearms (ICD-10: X72–75) and Jumping (ICD-10: X80) were also investigated separately.

Noise Exposure Data

The same noise exposure data used in a previous publication investigating cardiovascular disease and transportation noise in the SNC was used in our study.[45] These data were originally developed for the Short and Long Term Effects of Transportation Noise Exposure (SiRENE) project and were available for census years 2001 and 2011.[46,47] The database contains modeled noise exposure levels for the three main sources of transportation noise, using the following calculation methods: road traffic (source model sonROAD[48] and propagation model StL-86[49]) railways (source model sonRAIL[50] and propagation model SEMIBEL[51]) and aircraft (FLULA2[52,53]). Concerning aircraft noise, the model included estimates based on air traffic data of the three international civil airports (Zurich, Geneva, and Basel), as well as for the largest military airfield situated in Payerne.

The main noise metric used was the source-specific Lden, which is a weighted logarithmic mean of daily noise exposure with a penalty of 5 dB for evening (1900–2300 hours) and 10 dB for nighttime (2300–0700 hours) noise. The intermittency ratio (IR)[54] during the night was also available. This noise metric describes how impactful single noise events are in contrast to background noise. The values of IR range from 0%, meaning single events do not substantially exceed long-term average noise, to 100%, meaning that all noise exposure is produced by individual noise events. Additionally, the number of nighttime noise events (i.e., events 3 dB louder than background noise) was available. Both nighttime IR and number of events were not source-specific but calculated considering all three noise sources. Source-specific Lden at the most exposed façade and corresponding IR as well as the number of events were assigned to participants based on residential location (geocode and floor of residence, using a default middle floor of the building if exact floor was not known[55,56]). To account for background noise from various sources, Lden values were left censored at 35 dB for road traffic noise and 30 dB for railway and aircraft noise.[56]

Noise Exposure Assignment

As described in Vienneau et al.,[45] the follow-up was divided into three 5-y periods (2001–2005, 2006–2010, 2011–2015) to support time-varying analysis accounting for potential time trends and changes of residence.[57] Both residential geocodes and noise estimates were available for 2001 and 2011. Hence, the 2001 noise exposure estimates were assigned for the first period (2001–2005) and the 2011 noise exposure estimates to the third period (2011–2015), based on the residential address at the beginning of the period. Using the 2010 census question "living in the same community 5 years before" and moving dates, the exposure assignment for the middle period was constructed as follows. For people who had not moved or moved after 2006, the 2001 noise data was used for the middle period (2006–2010) because these participants were believed to still be living at the same residence that they lived at in 2001. For people who moved before 2006, the 2011 noise data and updated residential geocodes were used for the middle period (2006–2010).

Covariates

A directed acyclic graph (DAG) was drawn to identify potentially confounding factors (Figure S2). This led to the identification of the following factors: degree of urban, air pollution, green space, civil status, and socioeconomic position. The following individual sociodemographic variables available from the SNC were included to represent socioeconomic position: education level (compulsory education or less, upper secondary level education, tertiary level education), mother tongue (German and Rhaeto-Romansh, French, Italian, other language), nationality (Swiss, non-Swiss), and local index of socioeconomic position (local SEP in quartiles). The local-SEP index used is calculated for a small local area of 50 nearest neighbors and considered median rent per living space, education level and type of occupation of the household head and number of inhabitants per room.[58] Additionally, civil status (single, married, widowed, divorced) and degree of urban (urban, peri-urban, rural) were included as potential confounders and sex (female, male) as a covariate. The definition of degree of urban was performed for every community by the Swiss Federal Office for statistics based on morphological criteria such as population number and density as well as functional criteria such as commuter flows[59] and is part of the SNC data set. Because socioeconomic status was identified as one of the most important possible confounders in this study, area-level SEP and unemployment rate were also calculated at community ($n = 2{,}896$ in 2001, $n = 2{,}585$ in 2011) and cantonal ($n = 26$) level to reflect different aspects of SEP on different levels. The community- and cantonal-level SEP variables were derived by averaging the local-SEP index of all individuals within the respective area. Unemployment rates were available from the SNC and defined as percentage of the working-age population (20–65 y) unemployed. All covariates were available at baseline in 2001, whereas some covariates were also available at the start of the third period coinciding with the 2011 census. Those updated included civil status, nationality, local SEP, area SEP, and unemployment rate, whereas for other variables the baseline values were retained.

Concerning potentially confounding environmental exposures, $PM_{2.5}$ concentration (micrograms per cubic meter) was selected as marker for air pollution in the main model, whereas NO_2 concentrations (micrograms per cubic meter) were used for sensitivity analyses. Maps for both pollutants for the year 2010 were available from validated European 100 m × 100 m hybrid land use regression models developed based on AirBase routine monitoring data, satellite observations, dispersion model estimates, and

land use and traffic data. The model predictions for 2010 correlated highly with predictions in other years[60]; thus the 2010 estimates were considered relevant for all three 5-y periods. Air pollution exposure was updated according to residence history at the beginning of each of the three time periods.

As a possible confounder, greenness measured as mean NDVI with a 500-m buffer around participants' addresses was included as a covariate in the main model. NDVI exposure derived from a data set for 2014 previously constructed for and used in the SNC (using 30×30 m resolution, cloud-free Landsat scenes from summer months).[37] NDVI exposure was applied to the geocodes at the beginning of each of the three time periods (2001, 2006, and 2011), thus updating residential greenness for individuals who moved during our study period.

Statistical Analysis

The Cox proportional hazards model was applied to assess associations between death by all intentional self-harm (ICD-10: X60–84, excluding X61.8, X61.9, and X81–82) as well as the specific outcome subclasses [Poisoning (ICD10: X60–69, excluding X61.8 and X61.9), Hanging (ICD-10: X70), Firearms (ICD-10: X72–75), and Jumping (ICD-10: X80)] and exposure to each transportation noise source, air pollution, and NDVI, with age as timescale and stratified by sex. Adherence to the proportional hazards assumption was tested by calculating covariate-specific Schoenfeld residuals over time. Sex, time period, local SEP, civil status, and education level were included as strata because these covariates violated the proportional hazards assumption. To consider residential history and adjust for time trends in noise exposure and mortality, calendar time was adjusted for by dividing follow-up into three periods of 5 y each (2001–2005, 2006–2010, 2011–2015). Follow-up was continued until failure (i.e., death by suicide) or censoring (i.e., death by any other cause; emigration) or end of the follow-up period on 31 December 2015. Because some participants have exposure to more than one transportation noise source, we included road traffic, railway, and aircraft noise as well as air pollution and NDVI in a single model. As done previously,[55] this approach allows identification of mutually independent associations of any single exposure with the outcome. Results were calculated and reported as hazard ratio (HR) and 95% CIs per 10-dB increase in Lden for each transportation noise source, per 10-$\mu g/m^3$ increase in $PM_{2.5}$ concentration and per 0.1 increase in NDVI.

E-values were calculated for the main findings. The e-value is a measure for the potential effect of residual confounding, which is interpreted as the strength of association that an unmeasured confounder would need to have with both the exposure and the outcome, conditional on the measured covariates in the model, to be fully responsible for the observed exposure–outcome association.[61] The absolute excess risk for the main findings was calculated by multiplying the suicides/100,000 person-years (PY) by the excess risk (HR-1). Natural splines with 3 degrees of freedom (df) were used to assess the exposure–response relationship.

Incremental model adjustments were applied. Model 0, or the base model, included the Lden variables for the three noise sources, age as time scale, strata sex, and 5-y period. In model 1, the individual sociodemographic covariates (civil status, education, mother tongue, nationality, local-SEP index) were added. Model 2 added to model 1 the area-SEP and unemployment variables. Model 3 additionally adjusted for air pollution measured as continuous $PM_{2.5}$ exposure and NDVI. As a sensitivity analysis, Model 3b included continuous NO_2 exposure instead of $PM_{2.5}$. Two additional models also included noise eventfulness at night, parameterized in model 4a as quartiles of IR and in model 4b as quartiles of number of events. Variance inflation factor (VIF <5) was used *a posteriori* to evaluate multicollinearity between the three Lden variables, IR, number of events, and the air pollution variables.[62,63] Pearson correlation coefficient was calculated to describe correlation between the different exposures.

The main analysis was conducted for the full cohort, combining both sexes and all ages. Separate HRs were also calculated for males and females, and for three separate age groups (15–29, 30–65, over 65 y). Effect modification by SEP was explored by stratifying the analysis by quartiles of the local-SEP index. Additional analyses included stratified analysis by degree of urban and civil status (married vs. single/divorced/widowed). Interaction between air pollution and road traffic noise was investigated using a model with categorical exposures corresponding to quartiles. Likelihood-ratio testing was applied to test whether the interaction term improved model fit. A separate analysis was conducted that investigated the risk in groups exposed to one, two, or three noise sources above 50 dB Lden in comparison with that of participants with exposure to all sources below 50 dB (= reference group). This cut-off was determined based on the shape of the exposure–response functions we derived in this study, as well as the distribution of noise in our sample. This last analysis was adjusted for $PM_{2.5}$, NDVI, and the same individual sociodemographic and regional covariates as in the main analysis.

Analyses were conducted in Stata 16 (StataCorp LLC), and plots and splines were developed in R (version 4.0; R Development Core Team).

Results

Study Population

A total of 5,084,838 individuals living in Switzerland and age 15 y or older at baseline (1 January 2001) were included (Table 1). Follow-up lasted until 31 December 2015, resulting in 69,440,133 PY. Our sample consisted of slightly more females (51.6%), individuals with mostly Swiss nationality (81.4%), and predominantly speaking German (or Rhaeto-Romansh) as native language (65.1%). A majority were married (60.3%) and had more than compulsory education (71.7%). Almost half of the study population lived in peri-urban settings (45%), with more similar proportions living in urban (29.1%) and rural (25.9%) areas.

During the 15-y follow-up period, 11,265 deaths from intentional self-harm (excluding assisted suicide and suicide involving vehicles) occurred. Of these, 14.0% concerned people between 15 and 30 y of age, 64.8% people between 31 and 65 y, and 21.2% people older than 65 y. Roughly three-quarters (74.1%) of the deceased by suicide were males.

The mean exposure for road traffic noise was highest (54.4 dB Lden), followed by railway noise (38.6 dB) and aircraft noise (34.5 dB) (Table 2). Correlations between the different noise sources were low (Pearson $r = 0.04$–0.13). Both $PM_{2.5}$ and NO_2 concentrations were somewhat correlated with aircraft noise ($r = 0.41$ and 0.40, respectively), although only NO_2 showed some correlation with road traffic noise ($r = 0.42$; $r = 0.24$ for $PM_{2.5}$). Correlation between the two air pollutants was high ($r = 0.70$). See Figure S3 for the full correlation matrix.

Main Findings

Road traffic noise was associated with an increased risk of death by suicide in all of the models, with an HR of 1.040 (95% CI: 1.015, 1.065) per 10-dB increase in noise exposure in the full model (Model 3) adjusting for SEP, $PM_{2.5}$ exposure, and NDVI at place of residence (Figure 1; Table 3). Railway noise exposure was also associated with an increased risk of death by intentional self-harm, but it was of a smaller magnitude (HR = 1.022; 95% CI: 1.004, 1.041). For aircraft noise, no linear association was

Table 1. Population characteristics of the eligible participants from the Swiss National Cohort at baseline (2001).

Characteristic	2001 (Baseline)
Number of participants	5,084,838
Sex [% (*n*)]	
Female	51.6% (2,624,262)
Male	48.4% (2.460,576)
Age [% (*n*)]	
15–29 y	18.7% (948,618)
30–64 y	62.2% (3,163,489)
≥65	19.1% (972,731)
Mother tongue [% (*n*)]	
German and Rhaeto-Romansh	65.1% (3,312,465)
French	19.7% (999,495)
Italian	7.1% (360,538)
Other	8.1% (412,340)
Education [% (*n*)]	
Compulsory education or less	27.5% (1,398,715)
Upper secondary level	51.8% (2,633,811)
Tertiary level education	19.9% (1,011,479)
Child/unknown	0.8% (40,833)
Urbanization [% (*n*)]	
Urban	29.1% (1,478,470)
Peri-urban	45% (2,289,923)
Rural	25.9% (1,316,445)
Marital status [% (*n*)]	
Single	26% (1,321,024)
Married	60.3% (3,066,705)
Divorced	7% (355,994)
Widowed	6.7% (341,115)
Nationality [% (*n*)]	
Swiss	81.4% (4,137,934)
Non-Swiss	18.6% (946,904)
Local-SEP [mean (SD)]	63.0 (10.6)
Area SEP region [mean (SD)]	62.8 (4.2)
Area SEP community-region [mean (SD)]	0.04 (5.2)
Area unemployment community [%, mean (SD)]	3.5 (0.7)
Area unemployment community-region [%, mean (SD)]	0 (1.2)

Note: SD, standard deviation; SEP, socioeconomic position.

observed (HR = 0.997; 95% CI: 0.965, 1.029). These results were robust across models, with smaller effect estimates mainly for road traffic noise after adding individual sociodemographic covariates (Model 0 to Model 1), but otherwise no major changes in the tendencies of the observed associations (Table S2). The observed increased risks translate to an absolute excess risk of 0.63 additional suicide deaths/100,000 PY for each 10-dB increase in road traffic noise and 0.36 additional suicide deaths/100,000 PY for each 10-dB increase in railway noise.

The observed tendencies were consistent across all outcome subgroups, with the exception of intentional self-harm involving guns, where no associations with transportation noise from any source were observed (Figure S4). The strongest associations were observed for poisoning, which is also referred to as a nonviolent suicide method [road traffic: HR = 1.106 (95% CI: 1.025, 1.193), railway: HR = 1.053 (95% CI: 0.997, 1.111)]. See Table S3 for all HRs and CIs. No association was found between measures for eventfulness of noise at night (number of events or IR) and risk for death by suicide (Table S4). In the analysis considering the number of noise sources above 50 dB Lden as exposure, a notable upward trend in risk was observed [One: HR = 1.053 (95% CI: 1.006, 1.102), Two: HR = 1.118 (95% CI: 1.049, 1.192), Three: HR = 1.252 (95% CI: 0.969, 1.619); Figure S5].

For air pollution, the main results (from Model 3) indicated a negative association of $PM_{2.5}$ exposure with death by intentional self-harm with large CIs [All individuals: HR = 0.900 (95% CI: 0.811, 0.998), Males: HR = 0.899 (95% CI: 0.798, 1.012), Females: HR = 0.918 (95% CI: 0.740, 1.137)] after adjustment for the sources of transportation noise and NDVI (Table 3).

Table 2. Levels of the different environmental exposures of the eligible participants from the Swiss National Cohort at baseline (2001).

Exposure	Mean (SD)
Road traffic noise [Lden (dB)]	54.4 (8.2)
Railway noise [Lden (dB)]	38.6 (11.1)
Aircraft noise [Lden (dB)]	34.5 (7.8)
$PM_{2.5}$ concentration ($\mu g/m^3$) [mean (SD)]	15.9 (2.4)
NO_2 concentration ($\mu g/m^3$) [mean (SD)]	23.7 (7.5)
NDVI exposure (no unit) [mean (SD)]	0.57 (0.11)

Note: dB, decibel; ICD, *International Statistical Classification of Diseases and Related Health Problems, 10th Revision*; Lden, day-evening-night level; NDVI, normalized difference vegetation index; SD, standard deviation.

Investigation of an interaction between road traffic noise and $PM_{2.5}$ exposure using a categorical model (quartiles as exposure categories) did not indicate an interaction between these two exposures (see Table S5). Likelihood-ratio testing revealed that adding the interaction term did not significantly improve model fit ($p = 0.160$).

After adjusting for the three transportation noise sources and $PM_{2.5}$, residential greenness at the place of residence, measured as NDVI with a 500-m buffer, showed a negative association with risk of death by suicide in females, whereas no clear associations where observed in males or the total sample [All individuals: HR = 0.999 (95% CI: 0.978, 1.020), Males: HR = 1.016 (95% CI: 0.992, 1.041), Females: HR = 0.946 (95% CI: 0.908, 0.986)] (Table 3).

Exposure–Response Relationship

Based on the main Model 3, natural splines with 3 df showed a near linear association between intentional self-harm mortality and exposure to road traffic noise starting at around 50 dB Lden (Figure 2). For railway noise, a linear risk increase was observed beginning below 35 dB. Similarly, the risk started to increase linearly from just below 45 dB Lden for aircraft noise; however, below this value, where most of the observations were located, the exposure–response association was inverse.

Sensitivity Analysis

For all outcomes, adjusting for NO_2 instead of $PM_{2.5}$ did not change the associations with exposure to the different noise sources (see Figure S6). Not adjusting for transportation noise in the sensitivity analysis did not influence the null air pollution associations found in the main model 3, which included copollutant adjustment (Figure S7).

Effect Modification

The observed increased risk of death by suicide in the main model (Model 3) for road traffic and railway noise was higher in females [road traffic: HR = 1.058 (95% CI: 1.007, 1.112), railway: HR = 1.028 (95% CI: 0.992, 1.066)] than in males [road traffic: HR = 1.034 (95% CI: 1.006, 1.063), railway: HR = 1.021 (95% CI: 1.000, 1.043)] (Table 3). These tendencies were robust across all outcome subcategories, with an association also seen in females among suicides using firearms (see Table S3; Figure S8).

Concerning age groups, the effect of road traffic noise was comparable in the two younger age groups [15–30 y: HR = 1.079 (95% CI: 1.011, 1.152), 30–65 y: HR = 1.050 (95% CI: 1.019, 1.082)], whereas no effect was observed for individuals older than 65 y [HR = 0.994 (95% CI: 0.944, 1.047)]. For railway noise, associations were observed only in the two older age groups [30–65 y: HR = 1.027 (95% CI: 1.004, 1.051), >65 y: HR = 1.037 (95% CI: 0.998, 1.077)], whereas again no

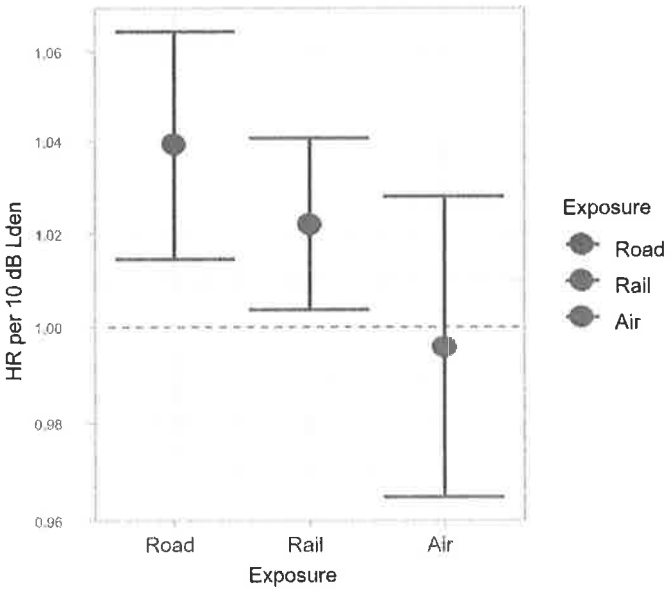

Figure 1. Association (HR and 95% CI) between transportation noise source (Lden) and mortality from all intentional self-harm (Main Model 3). Results from main model (M3) including noise exposures (road traffic noise, railway noise, and aircraft noise), $PM_{2.5}$ exposure, NDVI, age as timescale, sex as strata, individual sociodemographic covariates (civil status, education, mother tongue, nationality, urbanization, local SEP) and area covariates (area SEP-Index and unemployment rate). Outcome is mortality from intentional self-harm (ICD-10: X60–84, excl. ICD-10 X61.8, X61.9, X81–82). The numerical values of the results displayed in this figure can be found in Table 3. Note: CI, confidence interval; HR, hazard ratio; ICD-10, *International Statistical Classification of Diseases and Related Health Problems, 10th Revision*; NDVI, normalized difference vegetation index; SEP, socioeconomic position.

association was observed for aircraft noise in any age group (see Table 3; Figure S9).

Looking at effect modification by local-SEP index, an increased risk for both road traffic and railway noise was observed across all local-SEP quartiles, with the largest association with road traffic noise in the second quartile (HR = 1.085; 95% CI: 1.035, 1.138) and with railway noise in the third quartile (HR = 1.033; 95% CI: 0.996, 1.071). There were no indications of a trend toward lower or higher SEP categories (Figure S10; Table S6). No relevant differences were observed according to civil status (Table S7).

Stratified analysis according to urbanization revealed larger risk increases for suicide deaths associated with road traffic noise in urban (HR = 1.050; 95% CI: 1.004, 1.098) and peri-urban (HR = 1.045; 95% CI: 1.005, 1.087) areas than in rural settings (HR = 1.022; 95% CI: 0.979, 1.066). For railway noise, the largest risk increase was seen in the peri-urban setting (HR = 1.043; 95% CI: 1.014, 1.072). NDVI showed a negative association with risk of death by suicide in the urban setting (HR = 0.942; 95% CI: 0.912, 0.973), whereas no association was observed in the peri-urban setting and a positive association in the rural areas (HR = 1.072; 95% CI: 1.027, 1.119) (Table S8; Figure S11).

Discussion

Our findings suggest an association between exposure to transportation noise at the place of residence and the risk of death by intentional self-harm. Risk started to increase at levels of 50 dB or even lower, i.e., below the current WHO guideline levels for all noise sources. The observed associations were stronger in females than in males. We did not find any evidence for an increased risk of death by intentional self-harm due to air pollution. An inverse association with residential greenness was observed in females and in the urban setting.

There is hardly any research investigating long-term exposure to transportation noise and risk of suicide. The only previous study that investigated long-term noise exposure and suicide was conducted in Korea using environmental noise measurement data from a nationwide noise monitoring system, and not differentiating the exposure by noise source (e.g., noise caused by transportation and industrial and recreational activities). Mean monthly nighttime noise levels from the closest measurement stations were used as exposure. The authors reported a significantly increased risk for death by suicide per IQR increase of nighttime noise of 32% (95% CI: 2%, 70%) in younger adults (20–54 y, $n = 124{,}994$) and 43% (95% CI: 1%, 102%) in older adults (≥55 y, $n = 30{,}498$).[7] Although these results are difficult to directly compare to ours, it is notable that both suggest a risk increase for death by suicide in relation to noise exposure.

Overall, however, we believe our results should not be interpreted as suggesting that transportation noise has a direct influence on suicide or suicidal behavior, but rather that suicide as a surrogate for underlying mental health disorders is associated with transportation noise exposure. There is conclusive evidence that mental and behavioral disorders are the predominant comorbidities in suicide victims.[2,64] Hence, we reasoned to use suicide as a surrogate for underlying mental health disorders. The advantage of this approach is that it enables the use of the extensive mortality data in the SNC to study mental disorders. However, it is clear that there are also some limitations. For example, deaths by suicide represent only the "tip of the iceberg." Estimations suggest that worldwide, there are ~20 suicide attempts for every death by suicide,[9] and a Swiss study even noted 32 attempts for each death.[65] Additionally, suicide is a highly complex issue with many influencing factors, however, with psychiatric diseases and especially depressive disorders representing an important factor.[64]

When comparing our results on associations of transportation noise with suicide to existing literature on transportation noise and mental health, there is mixed agreement. For example, a systematic review and meta-analysis from 2020 reported an association between exposure to road traffic noise and anxiety [odds ratio (OR) = 1.08; 95% CI: 1.01, 1.15 per 10 dB Lden], whereas no effect was found for railway and aircraft noise.[30] Another systematic review and meta-analysis from the same year, in contrast, reported an association of aircraft noise exposure with risk for depression [12% (95% CI: 2%, 23%) increased risk per 10 dB Lden], whereas smaller risk increases were found for road traffic [3% (95% CI: −1%, 6%) per 10 dB Lden] and railway noise [2% (95% CI: −5%, 8%) per 10 dB Lden].[29] A more recent longitudinal study reported an association of road traffic noise and psychological ill health.[66] A study from Switzerland, also published after the above-mentioned reviews, found an association between incidence of depression and noise annoyance, whereas no significant association was found with noise exposure of any source.[67] An interesting observation is that results from a 2022 UK Biobank study suggested the opposite of the results in our study. In their large cross-sectional study, the authors reported an increased risk for major depression associated with $PM_{2.5}$ exposure but not an association with transportation noise exposure.[36] Although numerous studies report associations of transportation noise and mental health, the quality of evidence is considered low due to study design (mostly cross-sectional) and small sample sizes.[28,68,69] Additionally, heterogeneity in exposure assessments, outcome definitions and effect measures complicate a conclusive comparison of results. The consensus from the existing literature, however, is that an impact of transportation noise on mental health is highly probable,[70] which our findings further support.

Table 3. HR (95% CI) per 10-dB increase in Lden, 10-μg/m^3 increase in $PM_{2.5}$, and 0.1 increase per 0.1 NDVI for death by intentional self-harm, in mutually adjusted models.

	All intentional self-harm (ICD-10: X60–84, excluding X61.8, X61.9 and X81–82; N cases = 11,265)						Poisoning (X60–69)	Hanging (X70)	Firearms (X72–75)	Jumping (X80)
	All (n = 11,265)	Male (n = 8,476)	Female (n = 2,789)	Age 15–30 y (n = 1,508)	Age >30–65 y (n = 7,240)	Age >65 (n = 2,517)	All (n = 1,178)	All (n = 3,755)	All (n = 3,236)	All (n = 1,651)
Road traffic noise	1.040 (1.015, 1.065)[a]	1.034 (1.006, 1.063)	1.058 (1.007, 1.112)	1.079 (1.011, 1.152)	1.05 (1.019, 1.082)	0.994 (0.944, 1.046)	**1.106 (1.025, 1.193)**	1.060 (1.017, 1.105)	**1.007 (0.963, 1.053)**	1.009 (0.964, 1.055)
Railway noise	1.022 (1.004, 1.041)[b]	1.021 (1.000, 1.043)	1.028 (0.992, 1.066)	0.982 (0.934, 1.032)	1.027 (1.004, 1.051)	1.037 (0.998, 1.077)	**1.053 (0.997, 1.111)**	1.006 (0.974, 1.039)	**1.014 (0.980, 1.050)**	1.015 (0.98, 1.051)
Aircraft noise	0.997 (0.965, 1.029)	0.995 (0.959, 1.032)	1.005 (0.943, 1.071)	0.983 (0.901, 1.072)	1.015 (0.976, 1.056)	0.950 (0.887, 1.017)	**0.994 (0.902, 1.094)**	0.970 (0.917, 1.027)	**0.989 (0.933, 1.049)**	0.991 (0.935, 1.051)
$PM_{2.5}$	0.900 (0.811, 0.998)	0.899 (0.798, 1.012)	0.918 (0.74, 1.137)	0.978 (0.734, 1.303)	0.882 (0.776, 1.002)	0.915 (0.729, 1.149)	**0.943 (0.671, 1.324)**	0.913 (0.767, 1.086)	**0.961 (0.792, 1.167)**	0.906 (0.745, 1.101)
NDVI	0.999 (0.978, 1.020)	1.016 (0.992, 1.041)	0.946 (0.908, 0.986)	1.002 (0.948, 1.058)	0.986 (0.961, 1.012)	1.036 (0.991, 1.084)	**0.923 (0.868, 0.982)**	1.042 (1.005, 1.081)	**1.051 (1.009, 1.094)**	1.048 (1.007, 1.091)

Note: Results from main model (M3) including noise exposures (road traffic noise, railway noise, and aircraft noise), $PM_{2.5}$ exposure, NDVI within 500 m around the residence, age as timescale, sex as strata, individual sociodemographic covariates (civil status, education, mother tongue, nationality, urbanization, local SEP) and area covariates (area SEP-Index and unemployment rate). CI, confidence interval; HR, hazard ratio; Lden, day–evening–night level; NDVI, normalized difference vegetation index.

The E-value is a measure for the minimum strength of association that an unmeasured confounder would need to have with both the exposure and the outcome, conditional on the measured covariates, to fully explain the observed exposure–outcome association.

[a]E-Value for point estimate = 1.24.

[b]E-Value for point estimate = 1.17.

One difference in our results from existing evidence is that we did not find a clear association between aircraft noise and death by intentional self-harm. This finding in particular contradicts the results from the previously mentioned meta-analysis by Hegewald et al.,[29] which reported a rather large increased risk of depression per 10 dB aircraft noise. These results are mainly driven by one study by Seidler et al.[71] (Weight 98%), which was set around the airport of Frankfurt before the night flying ban was established in 2011. In contrast, in Zurich, the largest airport in Switzerland, a ban had already been established in 1972.[72] Hence, an interpretation of this contrasting result could be that noise (and specifically aircraft noise) during the night is the main contributor of negative effects on mental health. This finding is in agreement with the study by Min and Min,[7] which reported an increased risk of suicide with increasing nighttime environmental noise exposure. Additionally, this conclusion is supported by psychiatric literature judging sleep disturbances as an independent risk factor for most psychiatric disorders.[73] Alternatively, the absence of an association between aircraft noise and risk for death by suicide might also be due to residual confounding and exposure distribution, because aircraft noise in our study area (Switzerland) is mostly concentrated around larger cities (Basel, Geneva, Zurich), areas for which a 2016 mortality atlas of Switzerland showed average to lower suicide rates.[74] Additionally, the exposure–response curve for aircraft noise showed an inverse association in the very low exposure. Areas with low aircraft noise exposure are also more likely very rural, which might contribute to confounding. This theory is supported by results from another SNC study by Guseva Canu et al.[75] that identified men working in agriculture, hunting, and forestry, who tend to live in more rural settings, to be at an increased suicide risk in comparison with the risk found for men working in other professions.

Concerning effect modification, we consistently saw stronger associations of transportation noise and suicide risk in females than in males and also a protective effect of greenness exclusively in females in the main analysis. Because gender differences in suicide are well known, these associations are not surprising. In general, women make more suicide attempts, but suicide mortality is generally higher in men.[76] Accordingly, in our nationwide sample, 74.1% of the suicide victims were male. This discrepancy is often referred to as the "gender paradox of suicide." Among other factors, differences in psychopathology have been proposed as possible reasons for these gender differences.[77] Already in 2004, differences in underlying psychiatric disorders in male and female suicides were reported: although diagnoses with personality, childhood, and alcohol or substance disorders were more common in males, females had more often been diagnosed with depressive or affective disorders.[2] This underlying psychopathology may partly explain the observed effect modification in our results. The suspected mechanisms linking transportation noise exposure with mental health (prolonged stress reactions,[21] allostatic overload,[15] and sleep disturbances[22]) are thought to mostly increase the risk for affective disorders such as depression and anxiety disorders,[24,25,27] whereas effects on personality disorders and other psychiatric disorders such as schizophrenia seem less plausible. This evidence is also consistent with the existing, albeit limited, evidence investigating transportation noise exposure and mental health outcomes.[28] Hence, we interpret our results indicating a stronger effect of road traffic noise exposure on suicide risk in females as suggesting that such associations are mostly mediated through an increased risk for affective and anxiety disorders. Because reliable data on psychiatric diagnosis or medication prescription were not available, this hypothesis could not be tested with mediation analysis. Further studies are needed to elucidate the

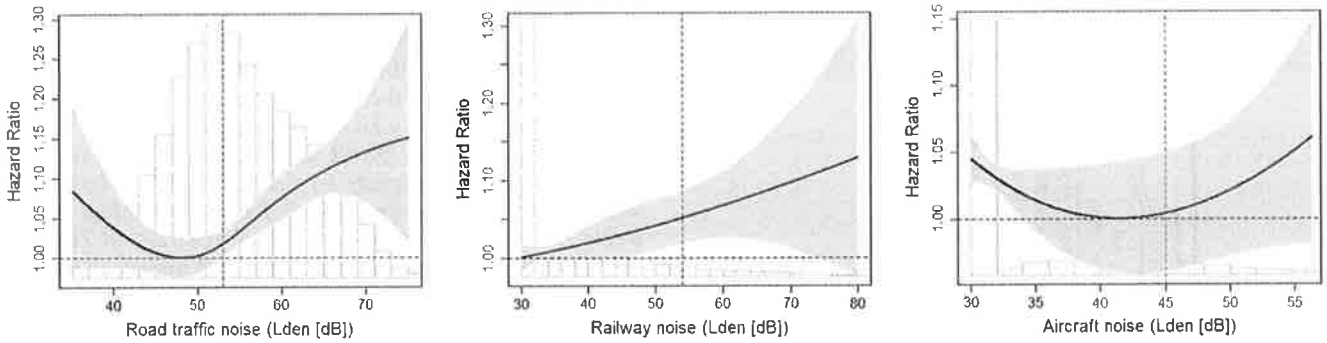

Figure 2. Exposure–response relationships for the association between transportation noise source [Lden (dB)] and mortality from intentional self-harm (ICD-10: X60–84, excl. ICD-10 X61.8, X61.9, X81–82). Natural splines (3 df, knots placed at tertiles of noise distribution) for the association between road traffic, railway, or aircraft noise (Lden, dB) and mortality from all intentional self-harm (ICD-10: X60–84, excluding ICD-10 X61.8, X61.9, X81–82). Same adjustments as in main model (M3), including noise exposures (road traffic noise, railway noise, and aircraft noise), $PM_{2.5}$ exposure, NDVI within 500 m around the residence, age as timescale, sex as strata, individual sociodemographic covariates (civil status, education, mother tongue, nationality, urbanization, local SEP, area SEP, and unemployment rate) were used. Vertical dashed red lines show source-specific WHO guideline levels: road traffic = 53 dB, railway = 54 dB, aircraft = 45 dB. (For interpretation of the references to color in this figure legend, see the web version of this article.) Internal knots placed at the following values (tertiles of respective noise distribution): road traffic noise: 50.64 dB, 57.84 dB; railway noise: 30 dB (lower bound and first tertile), 39.66 dB; aircraft noise: 30 dB (lower bound and first tertile), 32.62 dB. Mean and SD of the noise distribution can be found in Table 2. HR and 95% CI at Lden values indicated on the *x*-axis can be found in Table S9A–C. Note: CI, confidence interval; dB, decibel; df, degrees of freedom; HR, hazard ratio; ICD, *International Statistical Classification of Diseases and Related Health Problems, 10th Revision*; Lden, day-evening-night level; NDVI, normalized difference vegetation index; SD standard deviation; SEP, socioeconomic position; WHO, World Health Organization.

pathways through which transportation noise influences mental health.

Another interesting finding from our study concerns those on greenness. We observed a substantial risk reduction [HR = 0.942 (95% CI: 0.912, 0.973) per 0.1 NDVI] in the urban setting. This finding is in line with the findings of a Dutch longitudinal case–control study,[8] which also reported a reduced risk for suicide associated with more residential green space in urban but not rural regions. Conversely, however, we saw a strong association of higher NDVI with increased risk of suicide in the rural setting. We argue that this association might be spurious, because those areas with the highest NDVI in the rural setting are probably very rural areas, where a higher percentage of the population are agricultural workers. As mentioned above, this population is among the most at-risk professional groups in Switzerland.[75] Also, remote regions showed above-average suicide mortality in a 2016 mortality atlas.[74]

Regarding air pollution, we found no association between either $PM_{2.5}$ or NO_2 and suicide mortality. The lack of association was found in models both with and without adjusting for transportation noise (Figure S6). This lack of association is in contrast to many studies reporting an association between long-term and short-term exposure to air pollution and an increased risk for depression, as well as effects on suicides.[6,34–36] Most of these studies, except for the UK Biobank study,[36] however, did not adjust for exposure to transportation noise. It may thus also be that some of these previous results on air pollution have been confounded by transportation noise. Future studies exploring either the effects of air pollution or transportation noise exposure on mental health should consider that both exposures may play a role.

Strengths and Limitations

To our knowledge, this is the first study investigating long-term exposure to source-specific transportation noise and suicide mortality. The use of the Swiss National Cohort enabled following more than 5 million Swiss residents over 15 y of age in combination with high-quality noise models providing energy-based metrics is a strength of this study. This, in combination with adjustment for air pollution exposure using data from a validated land use regression model as well as NDVI, is a further asset.

Even though this study is based on very comprehensive data and noise exposure assessment, some exposure misclassification is unavoidable, for instance, for individuals who have moved during the study period. To minimize this, we implemented an approach to account for this spatial change using census data and address history to update the estimated noise exposure at the beginning of each 5-y period. Additionally, as is always the case when using noise exposure estimates at participants' home addresses, our estimated exposures do not reflect the exposure the participants experienced when away from home.[78]

Some residual confounding, mostly by SEP, can also not be dismissed. To diminish this, we adjusted for SEP on different levels. The rationale behind this approach was that some levels might better correspond to different types of possible confounders. For example, regional markers might better reflect the quality of health services, community markers contribute information about the population mix, and the near-individual local-SEP index plus actual individual covariates (e.g., civil status and education) would correspond best with health behavior. However, this probably still did not result in a perfect reflection of individual participants' SEP. Another possible source of residual confounding is urbanization. However, considering the spatial pattern of suicide in Switzerland, urban/rural differences mostly occur in specific age groups, vary across language regions,[74] and might also partially be related to religion.[79] We do not assume that such patterns are systematically correlated with transportation noise. One exception could be in the very rural setting, where noise (and air pollution) exposure is typically very low, but suicide risk might be higher. Such confounding would, however, have led to an underestimation of our effect estimates. Looking at the e-value of 1.24 for our main findings, we conclude that it is unlikely that uncaptured features of urbanization or SEP could be that strongly correlated with both transportation noise and suicide across our sample of more than 5 million individuals.

Additional limitations are the lack of data on medical records regarding psychiatric diagnoses and medication intake as well as lifestyle factors such as smoking or alcohol consumption in the SNC. Knowledge about suicide attempts as an additional outcome reflective of underlying severe mental health disorders would have further improved our study.

Conclusion

In this nationwide administrative cohort study, we found a robust association of exposure to transportation noise and the risk for death by intentional self-harm. Though information on mental health status was not available, these findings suggest that suicide as a surrogate for mental health disorders may be related to transportation noise, adding to the growing body of evidence for such effects. Further research is needed to solidify the understanding of the complex relationship between noise exposure, other environmental stressors such as air pollution, socioeconomic factors, and mental health. However, our results emphasize the public health importance of efforts to reduce the population exposed to high levels of transportation noise.

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The SNC was approved by the Ethics Committees of the Canton Bern (No KeK 153/2014, PB_2020-00050).

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Suicide and Transportation Noise: A Prospective Cohort Study from Switzerland

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Background: Although plausible from a pathophysiological point of view, robust evidence for effects of transportation noise on mental health remains scarce. Meanwhile, psychiatric diseases are among the most prevalent noncommunicable diseases worldwide, and suicide as a mortality outcome highly connected to mental disorders presents a pressing public health issue. The aim of this study was to investigate the association between source-specific transportation noise, particulate matter (PM) air pollution, residential greenness, and suicide by means of a nationwide cohort study.

Methods: Road traffic, railway and aircraft noise exposure as well as exposure to air pollution [PM with aerodynamic diameter ≤ 2.5 μm ($PM_{2.5}$)] and greenness [normalized difference vegetation index (NDVI)] were linked to 5.1 million adults (age 15 y and older) in the Swiss National Cohort, accounting for their address history. Mean noise exposure in 5-y periods was calculated. Individuals were followed for up to 15 y (2001–2015). Time-varying Cox regression models were applied to deaths by suicide (excluding assisted suicide). Models included all three noise sources, $PM_{2.5}$, and NDVI plus individual and spatial covariates, including socioeconomic status. Effect modification by sex, age, socioeconomic indicators, and degree of urbanization was explored.

Results: During the follow-up, there were 11,265 suicide deaths (10.4% poisoning, 33.3% hanging, 28.7% firearms, 14.7% falls). Road traffic and railway noise were associated with total suicides [hazard ratios: 1.040; 95% confidence interval (CI): 1.015, 1.065; and 1.022 (95% CI: 1.004, 1.041) per 10 dB day-evening-night level (Lden)], whereas for aircraft noise, a risk increase starting from 50 dB was masked by an inverse association in the very low exposure range (30–40 dB). Associations were stronger for females than males. The results were robust to adjustment for residential greenness and air pollution.

Conclusion: In this longitudinal, nationwide cohort study, we report a robust association between exposure to road traffic and railway noise and risk of death by suicide after adjusting for exposure to air pollution and greenness. These findings add to the growing body of evidence that mental health disorders may be related to chronic transportation noise exposure. https://doi.org/10.1289/EHP11587

Introduction

Mental health disorders represent a pressing public health issue. In 2019, the prevalence of mental health disorders globally was estimated to be 13% [95% confidence interval (CI): 12.1, 14.0%], which translates to almost 1 billion people affected. In Switzerland, the estimated prevalence was slightly higher with 17.3% (95% CI: 15.9, 18.8%), translating to about 1.4 million people affected.[1] Although most mental health disorders primarily lead to morbidity and decreased quality of life, a mortality outcome closely related to mental illness is suicide.[2,3] Suicide is a complex, multicausal phenomenon, involving psychological, social, biological, and environmental factors. A study on suicide in the Swiss National Cohort confirmed that mental and behavioral problems were by far the most prevalent comorbidities in suicide victims across all professions, age groups, and genders.[4] Only recently research has started to also explore and identify possible environmental risk factors for suicide, with reported associations of an increased suicide risk with heat,[5] air pollution.[6] and noise.[7] On the other hand, residential greenness and urban green space have been recognized as environmental factors with protective properties.[8] Although suicide rates have decreased worldwide and in Switzerland in the last 20 y, the decline is not yet on course to reach the Sustainable Development Goal (SDG) aim of a reduction by one-third by 2030. The World Health Organization (WHO) report, "Suicide Worldwide in 2019," published in 2021, estimated that 703,000 people died from suicide in 2019 worldwide, which corresponds to 1.3% of all yearly deaths.[9] On the grounds of such numbers, reducing the occurrence of mental illnesses is a primary public health interest. Hence, understanding risk factors for the development of mental disorders and therefore for suicide is of utmost importance. In light of the growing urbanization worldwide, studying the role of urban environmental stressors as such potential risk factors can potentially yield insights of consequential importance concerning the promotion of mental health and prevention of psychiatric morbidity and mortality.

In recent years, noise has been recognized as one of the most impactful environmental stressors on health and well-being.[10] Among the sources of environmental noise, transportation noise and especially road traffic noise have emerged as the most prevalent and harmful. According to a European Environmental Agency (EEA) report, 20% of the European population (139 million people) in 2017 were estimated to live in areas with transportation noise levels that are considered harmful [>55 dB day-evening-night level (Lden)].[10] A more recent study investigating noise exposure in 700 cities in Europe estimated that 42% of the adult urban population are exposed to such harmful levels.[11] Due to this widespread occurrence, noise is the second most important driver of the environmental burden of disease in Europe, behind fine particulate matter (PM) air pollution. In numbers, exposure to transportation noise is estimated to be responsible for 400–1,500 disability adjusted life years lost each year per million people in Western Europe.[12] However, because more evidence including more outcomes has emerged since 2014, and, for example, effects on mental health were not included in the above-

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mentioned calculations, these numbers might actually represent an underestimation.

Concerning negative health effects related to noise exposure, there is growing evidence for diverse nonauditory effects, such as arterial hypertension, cardiovascular and metabolic diseases such as type 2 diabetes,[13–16] sleep disturbance,[17] annoyance,[18] as well as reduced quality of life and well-being[19]—and mental health and neurological disorders.[20] Although the exact pathways of the influences of noise on health remain somewhat unclear, there is evidence that noise causes physiological stress reactions involving heightened amygdalar activity,[21] allostatic overload,[13,15] and disturbed sleep.[22] Because these are all established risk factors for multiple mental health disorders, including depression,[23–27] an association of noise with poor mental health seems plausible from a pathophysiological perspective. However, the systematic review on noise-related mental health outcomes used for the 2018 WHO guidelines resulted in a judgment of very low-quality evidence for aircraft noise effects on depression and anxiety and a judgment of low-quality evidence for a null effect of road traffic or railway noise.[28] The review included 29 predominantly cross-sectional studies. Hence, the poor quality of evidence was attributed to a lack of robust studies investigating the mental health effects of different noise sources. A more recent meta-analysis of five studies found an increased risk of 12% (95% CI: 2%, 23%) for depression per 10 dB Lden of aircraft noise exposure.[29] The same study[29] also suggested a 2%–3% increased risk for depression per 10 dB Lden for railway noise based on three studies and for road traffic noise based on eleven studies. Another review and meta-analysis including nine studies showed an association between transportation noise and anxiety [odds ratio (OR) = 1.09; 95% CI: 0.97, 1.23 per 10 dB], while also rating the quality of evidence as low.[30] Since the publication of this meta-analysis, a Swiss prospective cohort study (SAPALDIA) reported a 7% increased risk for the incidence of depression per 10 dB Lden road traffic noise [relative risk (RR) = 1.07; 95% CI: 0.93, 1.22] and a 20% increased risk per 10 dB Lden aircraft noise (RR = 1.20; 95% CI: 0.92, 1.55). So far, only one study investigating the associations between long-term exposure to environmental noise and suicide has been conducted.[7] The authors examined the risk for death by suicide in relation to average nighttime noise exposure (including noise caused by transportation and industrial and recreational activities) in adults in Korea and reported an increased risk per interquartile range (IQR = 2.67 dB) of nighttime noise of 32% (95% CI: 2%, 70%) in younger adults and 43% (95% CI: 1%, 102%) in older adults. A time-series study from Spain investigating short-term effects of traffic noise exposure on suicides and emergency admission for depression and anxiety reported an increased risk for both outcomes.[31]

In comparison, the effects of air pollution on mental health have received more attention and have been studied more thoroughly. Air pollutants have been shown to cause oxidative stress and neuroinflammation and to trigger stress responses with stress hormone release, which are the major hypothesized mechanisms linking air pollution and adverse mental health outcomes.[32,33] A systematic review and meta-analysis published in 2022 including 39 studies reported significant associations between long-term exposure to various air pollutants ($PM_{2.5}$, NO_2, SO_2, CO) and risk of depression. The largest risk increase was observed for PM with aerodynamic diameter ≤ 10 μm (PM_{10}) [RR = 1.092 (95% CI: 0.988, 1.206) per 10-$\mu g/m^3$ increase in exposure]. Smaller effects were also reported per 10-$\mu g/m^3$ increase of short-term exposure to $PM_{2.5}$ [RR = 1.009 (95% CI: 1.007, 1.011)], PM_{10} [RR = 1.009 (95% CI: 1.006, 1.012)], O_3 [RR = 1.011 (95% CI: 0.997, 1.026)], NO_2 [RR = 1.022 (95% CI: 1.012, 1.033)] and SO_2 [RR = 1.024 (95% CI: 1.010, 1.037)].[34] Another systematic review and meta-analysis from 2019 found similar results for depression, and also reported associations between short-term PM_{10} exposure and suicide risk [RR = 1.02 (95% CI: 1.00, 1.03) per 10 $\mu g/m^3$ at lag 0–2 d, including four studies].[6] These results were compiled in a more recent systematic review and meta-analysis from 2021 that included 10 studies, reporting a 2% (95% CI: 1%, 3%) risk increase for suicide per 10 $\mu g/m^3$ $PM_{2.5}$ exposure.[35] One limitation of these reviews is that most of the included studies have not adjusted for exposure to possible confounders such as transportation noise. A recent large cross-sectional study from the UK Biobank studying $PM_{2.5}$ and road traffic noise exposure, however, reported an increased risk for depression associated with $PM_{2.5}$ exposure, but no association with road traffic noise exposure was found.[36]

Residential greenness or green space is another exposure of interest in environmental epidemiology as a protective factor for health and well-being. For example, higher levels of greenness [normalized difference vegetation index (NDVI)] around people's place of residence have been associated with a lower risk of natural-cause mortality [HR = 0.94 (95% CI: 0.93, 0.95) per IQR (0.14 NDVI in a 500-m buffer)] in a large Swiss cohort study.[37] Concerning mental health, a Dutch study found a decreased risk for death by suicide in communities with high green space proportion (>85%) in comparison with communities with little (<25%) green space [RR = 0.879 (95% CI: 0.779, 0.991)].[38] Beyond suicide, a systematic review from 2020 suggested several beneficial effects of access to green space on adolescents' mental health, including fewer depressive symptoms and improved general mental health.[39] Multiple pathways are posited for this positive association, including that greener living environments or green space availability encourage healthy behavior, and that such factors can aid in stress relief.[40]

This study investigates the association between exposure to road traffic, railway, and aircraft noise and the risk of death by suicide in a longitudinal, nationwide research cohort in Switzerland. We hypothesized that people exposed to higher levels of transportation noise are more likely to develop mental health disorders such as depression and therefore have a higher risk of death by suicide, independent of coexposure to air pollution and residential greenness as well as socioeconomic position. By using suicide as a surrogate, we aimed to add to the understanding of whether transportation noise exposure affects mental health.

Methods

Study Population

The Swiss National Cohort (SNC) is a longitudinal, population-based research cohort. It links births, mortality, and emigration registries with the former national decennial census and, since 2010, with the annual Registry Based Census.[41,42] The linkages in the SNC from 2010 onward are deterministic using a personal identifier, whereas earlier linkages were performed probabilistically based on variables such as date of birth, sex, civil status, nationality, religion, and place of residence. No validation of the probabilistic linkage is available, but comparison with the deterministic linkages from 2010 and onward allows the discovery and exclusion of mismatches. Close to complete representation of the whole population is ensured by compulsory census participation, which is reflected in 98.6% of the population being included in the 4 December 2000 census.[43] The SNC was approved by the ethics committees of the Cantons of Zurich and Berne.

For the current study, we used the SNC as a closed cohort that included data from 1 January 2001 to 31 December 2015 for a total of 7.28 million individuals. After excluding individuals

below 15 y of age at baseline (17.5% of the full population), data with a mismatch between probabilistic and deterministic SNC linkage (i.e., incorrect probabilistic linkage, 8.2%), missing residential coordinates or individuals living in an institution (5.4%), missing information on covariates (i.e., education or socioeconomic position) (2.5%), or missing exposure data (0.2%), the final sample used for analysis consisted of 5.1 million observations (See Supplement Table S1). No imputations were performed.

Outcome

The outcome of interest was defined as all intentional self-harm [i.e., total suicides; *International Statistical Classification of Diseases and Related Health Problems, 10th Revision* (ICD-10): X60–84, excluding X61.8, X61.9, and X81–82] as cause of death. The SNC contains records from all deaths occurring in Switzerland from 1991 up to 2019 that included cause of death as ICD codes. Regarding exclusions, ICD-Codes X61.8 (right-to-die organization on death certificate) and X61.9 (Poisoning with pentobarbital; the drug used by right-to-die organizations) have been used to indicate assisted suicide since 1998.[44] Additionally, we suspected suicides involving vehicles (ICD-10: X81–82) to be spuriously associated with railway noise, due to confounding by proximity and therefore availability of the method. Because preliminary analysis confirmed this suspicion (see Figure S1), these outcomes were also excluded from the main analysis. The specific suicide subclasses Poisoning (ICD10: X60–69, excluding X61.8 and X61.9), Hanging (ICD-10: X70), Firearms (ICD-10: X72–75) and Jumping (ICD-10: X80) were also investigated separately.

Noise Exposure Data

The same noise exposure data used in a previous publication investigating cardiovascular disease and transportation noise in the SNC was used in our study.[45] These data were originally developed for the Short and Long Term Effects of Transportation Noise Exposure (SiRENE) project and were available for census years 2001 and 2011.[46,47] The database contains modeled noise exposure levels for the three main sources of transportation noise, using the following calculation methods: road traffic (source model sonROAD[48] and propagation model StL-86[49]) railways (source model sonRAIL[50] and propagation model SEMIBEL[51]) and aircraft (FLULA2[52,53]). Concerning aircraft noise, the model included estimates based on air traffic data of the three international civil airports (Zurich, Geneva, and Basel), as well as for the largest military airfield situated in Payerne.

The main noise metric used was the source-specific Lden, which is a weighted logarithmic mean of daily noise exposure with a penalty of 5 dB for evening (1900–2300 hours) and 10 dB for nighttime (2300–0700 hours) noise. The intermittency ratio (IR)[54] during the night was also available. This noise metric describes how impactful single noise events are in contrast to background noise. The values of IR range from 0%, meaning single events do not substantially exceed long-term average noise, to 100%, meaning that all noise exposure is produced by individual noise events. Additionally, the number of nighttime noise events (i.e., events 3 dB louder than background noise) was available. Both nighttime IR and number of events were not source-specific but calculated considering all three noise sources. Source-specific Lden at the most exposed façade and corresponding IR as well as the number of events were assigned to participants based on residential location (geocode and floor of residence, using a default middle floor of the building if exact floor was not known[55,56]). To account for background noise from various sources, Lden values were left censored at 35 dB for road traffic noise and 30 dB for railway and aircraft noise.[56]

Noise Exposure Assignment

As described in Vienneau et al.,[45] the follow-up was divided into three 5-y periods (2001–2005, 2006–2010, 2011–2015) to support time-varying analysis accounting for potential time trends and changes of residence.[57] Both residential geocodes and noise estimates were available for 2001 and 2011. Hence, the 2001 noise exposure estimates were assigned for the first period (2001–2005) and the 2011 noise exposure estimates to the third period (2011–2015), based on the residential address at the beginning of the period. Using the 2010 census question "living in the same community 5 years before" and moving dates, the exposure assignment for the middle period was constructed as follows. For people who had not moved or moved after 2006, the 2001 noise data was used for the middle period (2006–2010) because these participants were believed to still be living at the same residence that they lived at in 2001. For people who moved before 2006, the 2011 noise data and updated residential geocodes were used for the middle period (2006–2010).

Covariates

A directed acyclic graph (DAG) was drawn to identify potentially confounding factors (Figure S2). This led to the identification of the following factors: degree of urban, air pollution, green space, civil status, and socioeconomic position. The following individual sociodemographic variables available from the SNC were included to represent socioeconomic position: education level (compulsory education or less, upper secondary level education, tertiary level education), mother tongue (German and Rhaeto-Romansh, French, Italian, other language), nationality (Swiss, non-Swiss), and local index of socioeconomic position (local SEP in quartiles). The local-SEP index used is calculated for a small local area of 50 nearest neighbors and considered median rent per living space, education level and type of occupation of the household head and number of inhabitants per room.[58] Additionally, civil status (single, married, widowed, divorced) and degree of urban (urban, peri-urban, rural) were included as potential confounders and sex (female, male) as a covariate. The definition of degree of urban was performed for every community by the Swiss Federal Office for statistics based on morphological criteria such as population number and density as well as functional criteria such as commuter flows[59] and is part of the SNC data set. Because socioeconomic status was identified as one of the most important possible confounders in this study, area-level SEP and unemployment rate were also calculated at community ($n = 2{,}896$ in 2001, $n = 2{,}585$ in 2011) and cantonal ($n = 26$) level to reflect different aspects of SEP on different levels. The community- and cantonal-level SEP variables were derived by averaging the local-SEP index of all individuals within the respective area. Unemployment rates were available from the SNC and defined as percentage of the working-age population (20–65 y) unemployed. All covariates were available at baseline in 2001, whereas some covariates were also available at the start of the third period coinciding with the 2011 census. Those updated included civil status, nationality, local SEP, area SEP, and unemployment rate, whereas for other variables the baseline values were retained.

Concerning potentially confounding environmental exposures, $PM_{2.5}$ concentration (micrograms per cubic meter) was selected as marker for air pollution in the main model, whereas NO_2 concentrations (micrograms per cubic meter) were used for sensitivity analyses. Maps for both pollutants for the year 2010 were available from validated European 100 m × 100 m hybrid land use regression models developed based on AirBase routine monitoring data, satellite observations, dispersion model estimates, and

land use and traffic data. The model predictions for 2010 correlated highly with predictions in other years[60]; thus the 2010 estimates were considered relevant for all three 5-y periods. Air pollution exposure was updated according to residence history at the beginning of each of the three time periods.

As a possible confounder, greenness measured as mean NDVI with a 500-m buffer around participants' addresses was included as a covariate in the main model. NDVI exposure derived from a data set for 2014 previously constructed for and used in the SNC (using 30×30 m resolution, cloud-free Landsat scenes from summer months).[37] NDVI exposure was applied to the geocodes at the beginning of each of the three time periods (2001, 2006, and 2011), thus updating residential greenness for individuals who moved during our study period.

Statistical Analysis

The Cox proportional hazards model was applied to assess associations between death by all intentional self-harm (ICD-10: X60–84, excluding X61.8, X61.9, and X81–82) as well as the specific outcome subclasses [Poisoning (ICD10: X60–69, excluding X61.8 and X61.9), Hanging (ICD-10: X70), Firearms (ICD-10: X72–75), and Jumping (ICD-10: X80)] and exposure to each transportation noise source, air pollution, and NDVI, with age as timescale and stratified by sex. Adherence to the proportional hazards assumption was tested by calculating covariate-specific Schoenfeld residuals over time. Sex, time period, local SEP, civil status, and education level were included as strata because these covariates violated the proportional hazards assumption. To consider residential history and adjust for time trends in noise exposure and mortality, calendar time was adjusted for by dividing follow-up into three periods of 5 y each (2001–2005, 2006–2010, 2011–2015). Follow-up was continued until failure (i.e., death by suicide) or censoring (i.e., death by any other cause; emigration) or end of the follow-up period on 31 December 2015. Because some participants have exposure to more than one transportation noise source, we included road traffic, railway, and aircraft noise as well as air pollution and NDVI in a single model. As done previously,[55] this approach allows identification of mutually independent associations of any single exposure with the outcome. Results were calculated and reported as hazard ratio (HR) and 95% CIs per 10-dB increase in Lden for each transportation noise source, per 10-$\mu g/m^3$ increase in $PM_{2.5}$ concentration and per 0.1 increase in NDVI.

E-values were calculated for the main findings. The e-value is a measure for the potential effect of residual confounding, which is interpreted as the strength of association that an unmeasured confounder would need to have with both the exposure and the outcome, conditional on the measured covariates in the model, to be fully responsible for the observed exposure–outcome association.[61] The absolute excess risk for the main findings was calculated by multiplying the suicides/100,000 person-years (PY) by the excess risk (HR-1). Natural splines with 3 degrees of freedom (df) were used to assess the exposure–response relationship.

Incremental model adjustments were applied. Model 0, or the base model, included the Lden variables for the three noise sources, age as time scale, strata sex, and 5-y period. In model 1, the individual sociodemographic covariates (civil status, education, mother tongue, nationality, local-SEP index) were added. Model 2 added to model 1 the area-SEP and unemployment variables. Model 3 additionally adjusted for air pollution measured as continuous $PM_{2.5}$ exposure and NDVI. As a sensitivity analysis, Model 3b included continuous NO_2 exposure instead of $PM_{2.5}$. Two additional models also included noise eventfulness at night, parameterized in model 4a as quartiles of IR and in model 4b as quartiles of number of events. Variance inflation factor (VIF <5) was used *a posteriori* to evaluate multicollinearity between the three Lden variables, IR, number of events, and the air pollution variables.[62,63] Pearson correlation coefficient was calculated to describe correlation between the different exposures.

The main analysis was conducted for the full cohort, combining both sexes and all ages. Separate HRs were also calculated for males and females, and for three separate age groups (15–29, 30–65, over 65 y). Effect modification by SEP was explored by stratifying the analysis by quartiles of the local-SEP index. Additional analyses included stratified analysis by degree of urban and civil status (married vs. single/divorced/widowed). Interaction between air pollution and road traffic noise was investigated using a model with categorical exposures corresponding to quartiles. Likelihood-ratio testing was applied to test whether the interaction term improved model fit. A separate analysis was conducted that investigated the risk in groups exposed to one, two, or three noise sources above 50 dB Lden in comparison with that of participants with exposure to all sources below 50 dB (= reference group). This cut-off was determined based on the shape of the exposure–response functions we derived in this study, as well as the distribution of noise in our sample. This last analysis was adjusted for $PM_{2.5}$, NDVI, and the same individual sociodemographic and regional covariates as in the main analysis.

Analyses were conducted in Stata 16 (StataCorp LLC), and plots and splines were developed in R (version 4.0; R Development Core Team).

Results

Study Population

A total of 5,084,838 individuals living in Switzerland and age 15 y or older at baseline (1 January 2001) were included (Table 1). Follow-up lasted until 31 December 2015, resulting in 69,440,133 PY. Our sample consisted of slightly more females (51.6%), individuals with mostly Swiss nationality (81.4%), and predominantly speaking German (or Rhaeto-Romansh) as native language (65.1%). A majority were married (60.3%) and had more than compulsory education (71.7%). Almost half of the study population lived in peri-urban settings (45%), with more similar proportions living in urban (29.1%) and rural (25.9%) areas.

During the 15-y follow-up period, 11,265 deaths from intentional self-harm (excluding assisted suicide and suicide involving vehicles) occurred. Of these, 14.0% concerned people between 15 and 30 y of age, 64.8% people between 31 and 65 y, and 21.2% people older than 65 y. Roughly three-quarters (74.1%) of the deceased by suicide were males.

The mean exposure for road traffic noise was highest (54.4 dB Lden), followed by railway noise (38.6 dB) and aircraft noise (34.5 dB) (Table 2). Correlations between the different noise sources were low (Pearson $r = 0.04$–0.13). Both $PM_{2.5}$ and NO_2 concentrations were somewhat correlated with aircraft noise ($r = 0.41$ and 0.40, respectively), although only NO_2 showed some correlation with road traffic noise ($r = 0.42$; $r = 0.24$ for $PM_{2.5}$). Correlation between the two air pollutants was high ($r = 0.70$). See Figure S3 for the full correlation matrix.

Main Findings

Road traffic noise was associated with an increased risk of death by suicide in all of the models, with an HR of 1.040 (95% CI: 1.015, 1.065) per 10-dB increase in noise exposure in the full model (Model 3) adjusting for SEP, $PM_{2.5}$ exposure, and NDVI at place of residence (Figure 1; Table 3). Railway noise exposure was also associated with an increased risk of death by intentional self-harm, but it was of a smaller magnitude (HR = 1.022; 95% CI: 1.004, 1.041). For aircraft noise, no linear association was

Table 1. Population characteristics of the eligible participants from the Swiss National Cohort at baseline (2001).

Characteristic	2001 (Baseline)
Number of participants	5,084,838
Sex [% (*n*)]	
Female	51.6% (2,624,262)
Male	48.4% (2.460,576)
Age [% (*n*)]	
15–29 y	18.7% (948,618)
30–64 y	62.2% (3,163,489)
≥65	19.1% (972,731)
Mother tongue [% (*n*)]	
German and Rhaeto-Romansh	65.1% (3,312,465)
French	19.7% (999,495)
Italian	7.1% (360,538)
Other	8.1% (412,340)
Education [% (*n*)]	
Compulsory education or less	27.5% (1,398,715)
Upper secondary level	51.8% (2,633,811)
Tertiary level education	19.9% (1,011,479)
Child/unknown	0.8% (40,833)
Urbanization [% (*n*)]	
Urban	29.1% (1,478,470)
Peri-urban	45% (2,289,923)
Rural	25.9% (1,316,445)
Marital status [% (*n*)]	
Single	26% (1,321,024)
Married	60.3% (3,066,705)
Divorced	7% (355,994)
Widowed	6.7% (341,115)
Nationality [% (*n*)]	
Swiss	81.4% (4,137,934)
Non-Swiss	18.6% (946,904)
Local-SEP [mean (SD)]	63.0 (10.6)
Area SEP region [mean (SD)]	62.8 (4.2)
Area SEP community-region [mean (SD)]	0.04 (5.2)
Area unemployment community [%, mean (SD)]	3.5 (0.7)
Area unemployment community-region [%, mean (SD)]	0 (1.2)

Note: SD, standard deviation; SEP, socioeconomic position.

observed (HR = 0.997; 95% CI: 0.965, 1.029). These results were robust across models, with smaller effect estimates mainly for road traffic noise after adding individual sociodemographic covariates (Model 0 to Model 1), but otherwise no major changes in the tendencies of the observed associations (Table S2). The observed increased risks translate to an absolute excess risk of 0.63 additional suicide deaths/100,000 PY for each 10-dB increase in road traffic noise and 0.36 additional suicide deaths/100,000 PY for each 10-dB increase in railway noise.

The observed tendencies were consistent across all outcome subgroups, with the exception of intentional self-harm involving guns, where no associations with transportation noise from any source were observed (Figure S4). The strongest associations were observed for poisoning, which is also referred to as a nonviolent suicide method [road traffic: HR = 1.106 (95% CI: 1.025, 1.193), railway: HR = 1.053 (95% CI: 0.997, 1.111)]. See Table S3 for all HRs and CIs. No association was found between measures for eventfulness of noise at night (number of events or IR) and risk for death by suicide (Table S4). In the analysis considering the number of noise sources above 50 dB Lden as exposure, a notable upward trend in risk was observed [One: HR = 1.053 (95% CI: 1.006, 1.102), Two: HR = 1.118 (95% CI: 1.049, 1.192), Three: HR = 1.252 (95% CI: 0.969, 1.619); Figure S5].

For air pollution, the main results (from Model 3) indicated a negative association of $PM_{2.5}$ exposure with death by intentional self-harm with large CIs [All individuals: HR = 0.900 (95% CI: 0.811, 0.998), Males: HR = 0.899 (95% CI: 0.798, 1.012), Females: HR = 0.918 (95% CI: 0.740, 1.137)] after adjustment for the sources of transportation noise and NDVI (Table 3).

Table 2. Levels of the different environmental exposures of the eligible participants from the Swiss National Cohort at baseline (2001).

Exposure	Mean (SD)
Road traffic noise [Lden (dB)]	54.4 (8.2)
Railway noise [Lden (dB)]	38.6 (11.1)
Aircraft noise [Lden (dB)]	34.5 (7.8)
$PM_{2.5}$ concentration ($\mu g/m^3$) [mean (SD)]	15.9 (2.4)
NO_2 concentration ($\mu g/m^3$) [mean (SD)]	23.7 (7.5)
NDVI exposure (no unit) [mean (SD)]	0.57 (0.11)

Note: dB, decibel; ICD, *International Statistical Classification of Diseases and Related Health Problems, 10th Revision*; Lden, day-evening-night level; NDVI, normalized difference vegetation index; SD, standard deviation.

Investigation of an interaction between road traffic noise and $PM_{2.5}$ exposure using a categorical model (quartiles as exposure categories) did not indicate an interaction between these two exposures (see Table S5). Likelihood-ratio testing revealed that adding the interaction term did not significantly improve model fit ($p = 0.160$).

After adjusting for the three transportation noise sources and $PM_{2.5}$, residential greenness at the place of residence, measured as NDVI with a 500-m buffer, showed a negative association with risk of death by suicide in females, whereas no clear associations where observed in males or the total sample [All individuals: HR = 0.999 (95% CI: 0.978, 1.020), Males: HR = 1.016 (95% CI: 0.992, 1.041), Females: HR = 0.946 (95% CI: 0.908, 0.986)] (Table 3).

Exposure–Response Relationship

Based on the main Model 3, natural splines with 3 df showed a near linear association between intentional self-harm mortality and exposure to road traffic noise starting at around 50 dB Lden (Figure 2). For railway noise, a linear risk increase was observed beginning below 35 dB. Similarly, the risk started to increase linearly from just below 45 dB Lden for aircraft noise; however, below this value, where most of the observations were located, the exposure–response association was inverse.

Sensitivity Analysis

For all outcomes, adjusting for NO_2 instead of $PM_{2.5}$ did not change the associations with exposure to the different noise sources (see Figure S6). Not adjusting for transportation noise in the sensitivity analysis did not influence the null air pollution associations found in the main model 3, which included copollutant adjustment (Figure S7).

Effect Modification

The observed increased risk of death by suicide in the main model (Model 3) for road traffic and railway noise was higher in females [road traffic: HR = 1.058 (95% CI: 1.007, 1.112), railway: HR = 1.028 (95% CI: 0.992, 1.066)] than in males [road traffic: HR = 1.034 (95% CI: 1.006, 1.063), railway: HR = 1.021 (95% CI: 1.000, 1.043)] (Table 3). These tendencies were robust across all outcome subcategories, with an association also seen in females among suicides using firearms (see Table S3; Figure S8).

Concerning age groups, the effect of road traffic noise was comparable in the two younger age groups [15–30 y: HR = 1.079 (95% CI: 1.011, 1.152), 30–65 y: HR = 1.050 (95% CI: 1.019, 1.082)], whereas no effect was observed for individuals older than 65 y [HR = 0.994 (95% CI: 0.944, 1.047)]. For railway noise, associations were observed only in the two older age groups [30–65 y: HR = 1.027 (95% CI: 1.004, 1.051), >65 y: HR = 1.037 (95% CI: 0.998, 1.077)], whereas again no

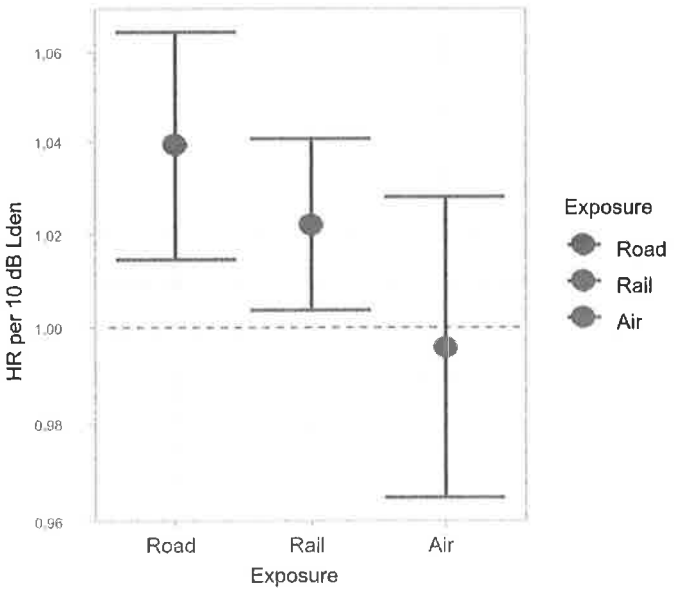

Figure 1. Association (HR and 95% CI) between transportation noise source (Lden) and mortality from all intentional self-harm (Main Model 3). Results from main model (M3) including noise exposures (road traffic noise, railway noise, and aircraft noise), $PM_{2.5}$ exposure, NDVI, age as timescale, sex as strata, individual sociodemographic covariates (civil status, education, mother tongue, nationality, urbanization, local SEP) and area covariates (area SEP-Index and unemployment rate). Outcome is mortality from intentional self-harm (ICD-10: X60–84, excl. ICD-10 X61.8, X61.9, X81–82). The numerical values of the results displayed in this figure can be found in Table 3. Note: CI, confidence interval; HR, hazard ratio; ICD-10, *International Statistical Classification of Diseases and Related Health Problems, 10th Revision*; NDVI, normalized difference vegetation index; SEP, socioeconomic position.

association was observed for aircraft noise in any age group (see Table 3; Figure S9).

Looking at effect modification by local-SEP index, an increased risk for both road traffic and railway noise was observed across all local-SEP quartiles, with the largest association with road traffic noise in the second quartile (HR = 1.085; 95% CI: 1.035, 1.138) and with railway noise in the third quartile (HR = 1.033; 95% CI: 0.996, 1.071). There were no indications of a trend toward lower or higher SEP categories (Figure S10; Table S6). No relevant differences were observed according to civil status (Table S7).

Stratified analysis according to urbanization revealed larger risk increases for suicide deaths associated with road traffic noise in urban (HR = 1.050; 95% CI: 1.004, 1.098) and peri-urban (HR = 1.045; 95% CI: 1.005, 1.087) areas than in rural settings (HR = 1.022; 95% CI: 0.979, 1.066). For railway noise, the largest risk increase was seen in the peri-urban setting (HR = 1.043; 95% CI: 1.014, 1.072). NDVI showed a negative association with risk of death by suicide in the urban setting (HR = 0.942; 95% CI: 0.912, 0.973), whereas no association was observed in the peri-urban setting and a positive association in the rural areas (HR = 1.072; 95% CI: 1.027, 1.119) (Table S8; Figure S11).

Discussion

Our findings suggest an association between exposure to transportation noise at the place of residence and the risk of death by intentional self-harm. Risk started to increase at levels of 50 dB or even lower, i.e., below the current WHO guideline levels for all noise sources. The observed associations were stronger in females than in males. We did not find any evidence for an increased risk of death by intentional self-harm due to air pollution. An inverse association with residential greenness was observed in females and in the urban setting.

There is hardly any research investigating long-term exposure to transportation noise and risk of suicide. The only previous study that investigated long-term noise exposure and suicide was conducted in Korea using environmental noise measurement data from a nationwide noise monitoring system, and not differentiating the exposure by noise source (e.g., noise caused by transportation and industrial and recreational activities). Mean monthly nighttime noise levels from the closest measurement stations were used as exposure. The authors reported a significantly increased risk for death by suicide per IQR increase of nighttime noise of 32% (95% CI: 2%, 70%) in younger adults (20–54 y, $n = 124{,}994$) and 43% (95% CI: 1%, 102%) in older adults (≥55 y, $n = 30{,}498$).[7] Although these results are difficult to directly compare to ours, it is notable that both suggest a risk increase for death by suicide in relation to noise exposure.

Overall, however, we believe our results should not be interpreted as suggesting that transportation noise has a direct influence on suicide or suicidal behavior, but rather that suicide as a surrogate for underlying mental health disorders is associated with transportation noise exposure. There is conclusive evidence that mental and behavioral disorders are the predominant comorbidities in suicide victims.[2,64] Hence, we reasoned to use suicide as a surrogate for underlying mental health disorders. The advantage of this approach is that it enables the use of the extensive mortality data in the SNC to study mental disorders. However, it is clear that there are also some limitations. For example, deaths by suicide represent only the "tip of the iceberg." Estimations suggest that worldwide, there are ~20 suicide attempts for every death by suicide,[9] and a Swiss study even noted 32 attempts for each death.[65] Additionally, suicide is a highly complex issue with many influencing factors, however, with psychiatric diseases and especially depressive disorders representing an important factor.[64]

When comparing our results on associations of transportation noise with suicide to existing literature on transportation noise and mental health, there is mixed agreement. For example, a systematic review and meta-analysis from 2020 reported an association between exposure to road traffic noise and anxiety [odds ratio (OR) = 1.08; 95% CI: 1.01, 1.15 per 10 dB Lden], whereas no effect was found for railway and aircraft noise.[30] Another systematic review and meta-analysis from the same year, in contrast, reported an association of aircraft noise exposure with risk for depression [12% (95% CI: 2%, 23%) increased risk per 10 dB Lden], whereas smaller risk increases were found for road traffic [3% (95% CI: −1%, 6%) per 10 dB Lden] and railway noise [2% (95% CI: −5%, 8%) per 10 dB Lden].[29] A more recent longitudinal study reported an association of road traffic noise and psychological ill health.[66] A study from Switzerland, also published after the above-mentioned reviews, found an association between incidence of depression and noise annoyance, whereas no significant association was found with noise exposure of any source.[67] An interesting observation is that results from a 2022 UK Biobank study suggested the opposite of the results in our study. In their large cross-sectional study, the authors reported an increased risk for major depression associated with $PM_{2.5}$ exposure but not an association with transportation noise exposure.[36] Although numerous studies report associations of transportation noise and mental health, the quality of evidence is considered low due to study design (mostly cross-sectional) and small sample sizes.[28,68,69] Additionally, heterogeneity in exposure assessments, outcome definitions and effect measures complicate a conclusive comparison of results. The consensus from the existing literature, however, is that an impact of transportation noise on mental health is highly probable,[70] which our findings further support.

Table 3. HR (95% CI) per 10-dB increase in Lden, 10-μg/m³ increase in $PM_{2.5}$, and 0.1 increase per 0.1 NDVI for death by intentional self-harm, in mutually adjusted models.

	All intentional self-harm (ICD-10: X60–84, excluding X61.8. X61.9 and X81–82; N cases = 11,265)						Poisoning (X60–69)	Hanging (X70)	Firearms (X72–75)	Jumping (X80)
	All (n = 11,265)	Male (n = 8,476)	Female (n = 2,789)	Age 15–30 y (n = 1,508)	Age >30–65 y (n = 7,240)	Age >65 (n = 2,517)	All (n = 1,178)	All (n = 3,755)	All (n = 3,236)	All (n = 1,651)
Road traffic noise	1.040 (1.015, 1.065)[a]	1.034 (1.006, 1.063)	1.058 (1.007, 1.112)	1.079 (1.011, 1.152)	1.05 (1.019, 1.082)	0.994 (0.944, 1.046)	**1.106 (1.025, 1.193)**	1.060 (1.017, 1.105)	1.007 (0.963, 1.053)	1.009 (0.964, 1.055)
Railway noise	1.022 (1.004, 1.041)[b]	1.021 (1.000, 1.043)	1.028 (0.992, 1.066)	0.982 (0.934, 1.032)	1.027 (1.004, 1.051)	1.037 (0.998, 1.077)	**1.053 (0.997, 1.111)**	1.006 (0.974, 1.039)	1.014 (0.980, 1.050)	1.015 (0.98, 1.051)
Aircraft noise	0.997 (0.965, 1.029)	0.995 (0.959, 1.032)	1.005 (0.943, 1.071)	0.983 (0.901, 1.072)	1.015 (0.976, 1.056)	0.950 (0.887, 1.017)	**0.994 (0.902, 1.094)**	0.970 (0.917, 1.027)	0.989 (0.933, 1.049)	0.991 (0.935, 1.051)
$PM_{2.5}$	0.900 (0.811, 0.998)	0.899 (0.798, 1.012)	0.918 (0.74, 1.137)	0.978 (0.734, 1.303)	0.882 (0.776, 1.002)	0.915 (0.729, 1.149)	**0.943 (0.671, 1.324)**	0.913 (0.767, 1.086)	0.961 (0.792, 1.167)	0.906 (0.745, 1.101)
NDVI	0.999 (0.978, 1.020)	1.016 (0.992, 1.041)	0.946 (0.908, 0.986)	1.002 (0.948, 1.058)	0.986 (0.961, 1.012)	1.036 (0.991, 1.084)	**0.923 (0.868, 0.982)**	1.042 (1.005, 1.081)	1.051 (1.009, 1.094)	1.048 (1.007, 1.091)

Note: Results from main model (M3) including noise exposures (road traffic noise, railway noise, and aircraft noise), $PM_{2.5}$ exposure, NDVI within 500 m around the residence, age as timescale, sex as strata, individual sociodemographic covariates (civil status, education, mother tongue, nationality, urbanization, local SEP) and area covariates (area SEP-Index and unemployment rate). CI, confidence interval; HR, hazard ratio; Lden, day-evening-night level; NDVI, normalized difference vegetation index.

The E-value is a measure for the minimum strength of association that an unmeasured confounder would need to have with both the exposure and the outcome, conditional on the measured covariates, to fully explain the observed exposure–outcome association.

[a]E-Value for point estimate = 1.24.

[b]E-Value for point estimate = 1.17.

One difference in our results from existing evidence is that we did not find a clear association between aircraft noise and death by intentional self-harm. This finding in particular contradicts the results from the previously mentioned meta-analysis by Hegewald et al.,[29] which reported a rather large increased risk of depression per 10 dB aircraft noise. These results are mainly driven by one study by Seidler et al.[71] (Weight 98%), which was set around the airport of Frankfurt before the night flying ban was established in 2011. In contrast, in Zurich, the largest airport in Switzerland, a ban had already been established in 1972.[72] Hence, an interpretation of this contrasting result could be that noise (and specifically aircraft noise) during the night is the main contributor of negative effects on mental health. This finding is in agreement with the study by Min and Min,[7] which reported an increased risk of suicide with increasing nighttime environmental noise exposure. Additionally, this conclusion is supported by psychiatric literature judging sleep disturbances as an independent risk factor for most psychiatric disorders.[73] Alternatively, the absence of an association between aircraft noise and risk for death by suicide might also be due to residual confounding and exposure distribution, because aircraft noise in our study area (Switzerland) is mostly concentrated around larger cities (Basel, Geneva, Zurich), areas for which a 2016 mortality atlas of Switzerland showed average to lower suicide rates.[74] Additionally, the exposure–response curve for aircraft noise showed an inverse association in the very low exposure. Areas with low aircraft noise exposure are also more likely very rural, which might contribute to confounding. This theory is supported by results from another SNC study by Guseva Canu et al.[75] that identified men working in agriculture, hunting, and forestry, who tend to live in more rural settings, to be at an increased suicide risk in comparison with the risk found for men working in other professions.

Concerning effect modification, we consistently saw stronger associations of transportation noise and suicide risk in females than in males and also a protective effect of greenness exclusively in females in the main analysis. Because gender differences in suicide are well known, these associations are not surprising. In general, women make more suicide attempts, but suicide mortality is generally higher in men.[76] Accordingly, in our nationwide sample, 74.1% of the suicide victims were male. This discrepancy is often referred to as the "gender paradox of suicide." Among other factors, differences in psychopathology have been proposed as possible reasons for these gender differences.[77] Already in 2004, differences in underlying psychiatric disorders in male and female suicides were reported: although diagnoses with personality, childhood, and alcohol or substance disorders were more common in males, females had more often been diagnosed with depressive or affective disorders.[2] This underlying psychopathology may partly explain the observed effect modification in our results. The suspected mechanisms linking transportation noise exposure with mental health (prolonged stress reactions,[21] allostatic overload,[15] and sleep disturbances[22]) are thought to mostly increase the risk for affective disorders such as depression and anxiety disorders,[24,25,27] whereas effects on personality disorders and other psychiatric disorders such as schizophrenia seem less plausible. This evidence is also consistent with the existing, albeit limited, evidence investigating transportation noise exposure and mental health outcomes.[28] Hence, we interpret our results indicating a stronger effect of road traffic noise exposure on suicide risk in females as suggesting that such associations are mostly mediated through an increased risk for affective and anxiety disorders. Because reliable data on psychiatric diagnosis or medication prescription were not available, this hypothesis could not be tested with mediation analysis. Further studies are needed to elucidate the

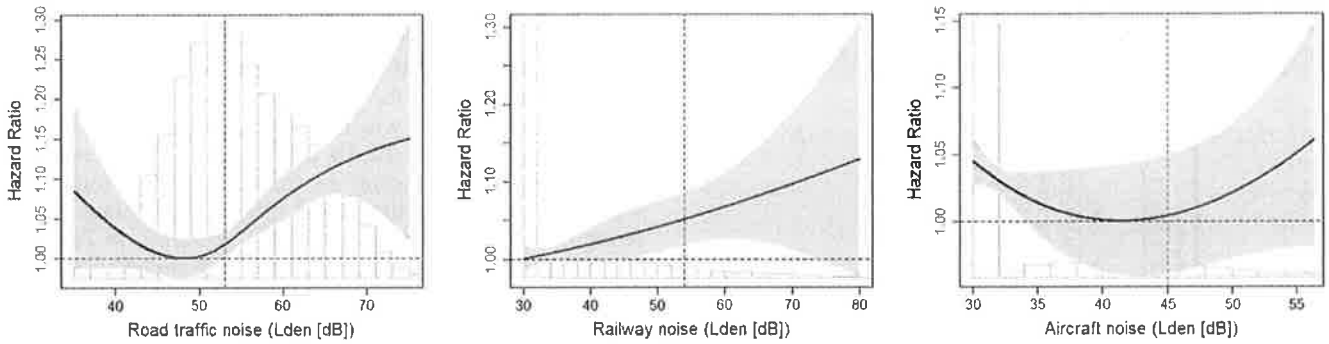

Figure 2. Exposure–response relationships for the association between transportation noise source [Lden (dB)] and mortality from intentional self-harm (ICD-10: X60–84, excl. ICD-10 X61.8, X61.9, X81–82). Natural splines (3 df, knots placed at tertiles of noise distribution) for the association between road traffic, railway, or aircraft noise (Lden, dB) and mortality from all intentional self-harm (ICD-10: X60–84, excluding ICD-10 X61.8, X61.9, X81–82). Same adjustments as in main model (M3), including noise exposures (road traffic noise, railway noise, and aircraft noise), $PM_{2.5}$ exposure, NDVI within 500 m around the residence, age as timescale, sex as strata, individual sociodemographic covariates (civil status, education, mother tongue, nationality, urbanization, local SEP, area SEP, and unemployment rate) were used. Vertical dashed red lines show source-specific WHO guideline levels: road traffic = 53 dB, railway = 54 dB, aircraft = 45 dB. (For interpretation of the references to color in this figure legend, see the web version of this article.) Internal knots placed at the following values (tertiles of respective noise distribution): road traffic noise: 50.64 dB, 57.84 dB; railway noise: 30 dB (lower bound and first tertile), 39.66 dB; aircraft noise: 30 dB (lower bound and first tertile), 32.62 dB. Mean and SD of the noise distribution can be found in Table 2. HR and 95% CI at Lden values indicated on the *x*-axis can be found in Table S9A–C. Note: CI, confidence interval; dB, decibel; df, degrees of freedom; HR, hazard ratio; ICD, *International Statistical Classification of Diseases and Related Health Problems, 10th Revision*; Lden, day-evening-night level; NDVI, normalized difference vegetation index; SD standard deviation; SEP, socioeconomic position; WHO, World Health Organization.

pathways through which transportation noise influences mental health.

Another interesting finding from our study concerns those on greenness. We observed a substantial risk reduction [HR = 0.942 (95% CI: 0.912, 0.973) per 0.1 NDVI] in the urban setting. This finding is in line with the findings of a Dutch longitudinal case–control study,[8] which also reported a reduced risk for suicide associated with more residential green space in urban but not rural regions. Conversely, however, we saw a strong association of higher NDVI with increased risk of suicide in the rural setting. We argue that this association might be spurious, because those areas with the highest NDVI in the rural setting are probably very rural areas, where a higher percentage of the population are agricultural workers. As mentioned above, this population is among the most at-risk professional groups in Switzerland.[75] Also, remote regions showed above-average suicide mortality in a 2016 mortality atlas.[74]

Regarding air pollution, we found no association between either $PM_{2.5}$ or NO_2 and suicide mortality. The lack of association was found in models both with and without adjusting for transportation noise (Figure S6). This lack of association is in contrast to many studies reporting an association between long-term and short-term exposure to air pollution and an increased risk for depression, as well as effects on suicides.[6,34–36] Most of these studies, except for the UK Biobank study,[36] however, did not adjust for exposure to transportation noise. It may thus also be that some of these previous results on air pollution have been confounded by transportation noise. Future studies exploring either the effects of air pollution or transportation noise exposure on mental health should consider that both exposures may play a role.

Strengths and Limitations

To our knowledge, this is the first study investigating long-term exposure to source-specific transportation noise and suicide mortality. The use of the Swiss National Cohort enabled following more than 5 million Swiss residents over 15 y of age in combination with high-quality noise models providing energy-based metrics is a strength of this study. This, in combination with adjustment for air pollution exposure using data from a validated land use regression model as well as NDVI, is a further asset.

Even though this study is based on very comprehensive data and noise exposure assessment, some exposure misclassification is unavoidable, for instance, for individuals who have moved during the study period. To minimize this, we implemented an approach to account for this spatial change using census data and address history to update the estimated noise exposure at the beginning of each 5-y period. Additionally, as is always the case when using noise exposure estimates at participants' home addresses, our estimated exposures do not reflect the exposure the participants experienced when away from home.[78]

Some residual confounding, mostly by SEP, can also not be dismissed. To diminish this, we adjusted for SEP on different levels. The rationale behind this approach was that some levels might better correspond to different types of possible confounders. For example, regional markers might better reflect the quality of health services, community markers contribute information about the population mix, and the near-individual local-SEP index plus actual individual covariates (e.g., civil status and education) would correspond best with health behavior. However, this probably still did not result in a perfect reflection of individual participants' SEP. Another possible source of residual confounding is urbanization. However, considering the spatial pattern of suicide in Switzerland, urban/rural differences mostly occur in specific age groups, vary across language regions,[74] and might also partially be related to religion.[79] We do not assume that such patterns are systematically correlated with transportation noise. One exception could be in the very rural setting, where noise (and air pollution) exposure is typically very low, but suicide risk might be higher. Such confounding would, however, have led to an underestimation of our effect estimates. Looking at the e-value of 1.24 for our main findings, we conclude that it is unlikely that uncaptured features of urbanization or SEP could be that strongly correlated with both transportation noise and suicide across our sample of more than 5 million individuals.

Additional limitations are the lack of data on medical records regarding psychiatric diagnoses and medication intake as well as lifestyle factors such as smoking or alcohol consumption in the SNC. Knowledge about suicide attempts as an additional outcome reflective of underlying severe mental health disorders would have further improved our study.

Conclusion

In this nationwide administrative cohort study, we found a robust association of exposure to transportation noise and the risk for death by intentional self-harm. Though information on mental health status was not available, these findings suggest that suicide as a surrogate for mental health disorders may be related to transportation noise, adding to the growing body of evidence for such effects. Further research is needed to solidify the understanding of the complex relationship between noise exposure, other environmental stressors such as air pollution, socioeconomic factors, and mental health. However, our results emphasize the public health importance of efforts to reduce the population exposed to high levels of transportation noise.

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The SNC was approved by the Ethics Committees of the Canton Bern (No KeK 153/2014, PB_2020-00050).

B.W., D.V., and M.R. worked on study concept and study design; D.V. conducted data preparation; B.W. and D.V. performed statistical modeling; and B.W. wrote and revised manuscript and performed all data interpretation, review, and commentary on the manuscript.

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The Superior Township Board of Trustees
C/O Lynette Findley, Clerk
3040 North Prospect
Superior Township, MI 48198

4/13/2023

Dear Members of the Board:

We are writing to respectfully oppose the proposed rezoning/land use changes at 3900 Dixboro Road, Ann Arbor, MI 48105.

We strongly support the township's Master Plan, and fear that inconsistent zoning rulings will undermine this plan created to guide our township's future land use.

Of high importance, we reference the statement: "*Isolated and abrupt changes in land uses and densities not consistent with Master Plan objectives and policies are considered spot zoning and are not recommended planning and zoning practice*." Superior Charter Township Master Plan, page 7-13.

No doubt you are receiving pressure from both sides, but we hope the Board of Trustees will be able to look critically at the proposed rezoning request. We are confident that you will find the proposed project is inconsistent with the Master Plan.

Sincerely,

Dr Brian Jacobson
Dr Allyn Young
3940 Fleming Ridge Drive
Ann Arbor, MI 48105
Residents of Superior Township, Michigan

For publication in 4/17/2023 Board of Trustees meeting packet.

From: Jean Rosella <jmr4000@hotmail.com>
Sent: Thursday, April 13, 2023 1:30 PM
To: Lynette Findley <lynettefindley@superior-twp.org>
Subject: Proposed Rezoning of 3900 Dixboro Road

Dear Board of Trustees:

This email is in response to the proposed rezoning notice sign placed at 3900 Dixboro Road in Superior Township.

As taxpayers, voters, and residents of Superior Township for the last twenty-five years, we express our concerns regarding a proposed rezoning of the Serras's property, located at 3900 Dixboro Road, SuperiorTownship. (We will be sending a similar letter to the Planning Commission as well.) Previously, we sent a letter to you on March 9, 2023, briefly stating our apprehensions about the rezoning. Also, on March 20, 2023, we sent a letter, in response to Martha Merritt's letter in support of Garrett's Space, to all decision makers.

In 1997, when we were looking for land upon which to build our home, we were told to contact Dennis Serras, which we did. Subsequently, we met Dennis at his home, which is the property in question. Dennis showed us his home and the surrounding property, expressing his love for the home itself (he called it his dream home), and the area too. He told us how much he loved the peace and the serenity of the area. He told us he was happy to be living in the country—happy to have a garden and to walk among nature without heavy traffic. Because of Dennis's love of the area and what we saw ourselves, we were sold. We purchased land from him and subsequently built our home. We moved into our home in April 1998, which is located at 4000 Fleming Ridge Drive, within walking distance to the Serras's property. Now, we fear that the rezoning of Dennis's home and property will alter the enjoyments, the peace, and the serenity, that we have had living in this area for the last twenty-five years.

Presently, to our knowledge, 3900 Dixboro Road is zoned as an A-2 Rural Zoning District. We don't believe the proposed request for rezoning by Garrett's Space comports with the intent of A-2 land uses. (And, it is our opinion this is not what Dennis Serras intended his land to be used for when he built his dream home.) Garrett's Space is not compatible in design with A-2 land uses. Rather, building such a development on this land would increase, among other things, the noise and the traffic in the area, and the many nuisance factors defined in the Ordinance. Moreover, of utmost concern is the degree to which there would be a problem with water and sanitary services. A-2, section 2.104 states: "[e]xtension of public water and sanitary [] service shall be prohibited unless such service is necessary to address public health and safety issues of development existing at the date of the adoption of the Ordinance." The Zoning Ordinance was adopted on August 14, 2008.

Simply put, Garrett's Space's request for rezoning is adverse to the use of the land. The impact upon us and the neighboring homes cannot be alleviated in any way. In fact, it is more than

obvious after reading Garrett's Spaces's site development plan that it is not compatible with the surrounding land uses.

Additionally, allowing a rezoning of the Serras's property sets a precedent for others who are unable, for whatever reasons, to sell their homes, to do the same. Our area in Superior Township will then go from a rural, peaceful, and serene area, to one of urban sprawl. Furthermore, does the Township want to give up the tax base of 3900 Dixboro Road should it be sold to a family?

We know that you have received many letters and calls expressing these concerns. We also know that the fears and the worries regarding the administration and management of Garrett's Space have been highlighted for you. We hope that you, as the Board of Trustees, the ultimate decision makers, can review this request for rezoning in an objective manner, putting aside the sympathy and empathy one has for the Halperts. The bigger picture of rezoning this land is the issue at hand.

We appreciate your attention to this matter.

Best,

John and Jean Rosella

From: Kathi Cohen <kathicohen@gmail.com>
Sent: Thursday, April 13, 2023 11:59 AM
To: Lynette Findley <lynettefindley@superior-twp.org>
Subject: Garrett's Space

[You don't often get email from kathicohen@gmail.com. Learn why this is important at https://aka.ms/LearnAboutSenderIdentification]

Dear Lynette,
I am writing to you today in support
of rezoning property in Superior Township to accommodate a facility for Garrett's Space. As part owners of Vibrant Life Assisted Living in Superior Township, we have no objection to this proposal for a much needed space with the mission of providing space, counseling, and programs for young adults who may be feeling suicidal. I hope you will approve this initiative.
Sincerely, Kathi Cohen

Vibrant Life
Senior Living

On Apr 16, 2023, at 4:06 PM, Kathleen Singer <goatie@umich.edu> wrote:

Dear Ms Findlay;

As a retired nurse who worked in the Univerity of Mchigan's Deparment of Psychiatry for 33 years, I am writing to support the construction of Garrett's Space, a residential community for young people suffering from depression, anxiety and other mental health issues, in Superior Township.

The need for mental health facilities for adolescents has been well documented. The National Institutes of Health reports that:

- Mental health challenges were the leading cause of disability and poor life outcomes in young people even before the COVID-19……
- from 2009 to 2019, the share of high school students who reported persistent feelings of sadness or hopelessness increased from 26% to 37%.
- Suicidal behaviors among high school students also increased 44% during the decade preceding the COVID-19
- Between 2007 and 2018, suicide rates among people ages 10-24 in the United States increased 57%, and early estimates show more than 6,600 suicide deaths among this age group in 2020.[1]

Garrett's Space is responding to this mental health crisis. Just as a rehab center is a therapeutic environment for someone recovering from surgery, Garrett's Space is a therapeutic environment for young people with mental health challenges. For young people struggling with depression, suicidal thoughts or anxiety, appointments with mental health workers symptoms can lead to much improvement but it often it is not enough for sustainable improvement.

I understand apprehension about having a "mental health" facility next door. Though the popular press and social media would have you believe otherwise, concerns that these young people are dangerous, psychotic or a threat to the community is not supported by research, Having mental illness does not a priori make a person more violent than any other person, nor, by the way, does it mean a person is less competent or intelligent.

A neighbor of Dawn Farms, also a residential program providing treatment for addictions, said, "Our houses are good neighbors."

I am sure you would find Garrett’s Space to a good neighbor.

Please support Garrett’s Space.

Thank you,

Kathleen Singer
1352 Marlborough Drive
Ann Arbor.Michigan

On Apr 15, 2023, at 9:18 PM, Kritika Versha <kritika.versha.19@gmail.com> wrote:

The Superior Township Board of Trustees
C/O Lynette Findley, Clerk
3040 North Prospect
Superior Township, MI 48198

Dear Trustees

As a resident of Superior Township, I am writing to oppose the rezoning of 3900 N. Dixboro for a residential treatment center for anxious, depressed and suicidal adults.

While I broadly support alternative treatment for mental health care, this particular facility at this specific site is a liability to the adjacent neighborhood and the entire township.

In order to skirt the zoning ordinance language, we have learned this facility will not be licensed. This is unlicensed transient housing.
Lack of licensure and lack of specificity in the zoning application gives Garrett's Space wide latitude to do what they please. For example, despite Garrett's Space's stated mission to treat adults age 18 to 28; this is not included in the zoning application and will give them the ability to house any adult there. Similarly, Garrett's Space directors have expressed the desire to house those immediately released from the hospital following a suicide attempt. Although they no longer propose this on their website, there is nothing in the zoning language that would stop this usage. Length of stay, number of patients, staffing and usage are in a constant state of flux.
Zoning goes with the land. What will this facility become if Garrett's Space fails?
This lack of licensure is a blank check to do as they please; this is an unregulated facility.

Additionally, while Garrett's Space offers many statistics, they do not provide any peer reviewed research to prove the facility will accomplish its goals. They provide only anecdotal evidence. They pride themselves on being the first of its kind anywhere. This is an experiment.
They say they will attempt to screen out those with imminently suicidal, those with psychosis or mania or who represent a danger to others. There are multiple studies that show psychological misdiagnosis is a common occurrence. Many psychological illnesses change presentation with time. There is no way to prevent some degree of misdiagnosis.
The organization has no history of in-patient treatment. Most of their therapy is online group therapy. There are no standards of care for a facility like this.

As nearby residents, we have many security concerns; both for our own safety and those of patients at the facility.
The directors of Garrett's Space have not publicly addressed any security issues.
There will only be 2 employees overnight securing 75 acres and 20 mood disordered, suicidal people in a coed facility. How will they keep the people there secure from intruders and from one another and from themselves?

The site lacks secure boundaries. Dennis Serras, deceased owner of the property frequently walked from his home at 3900 Dixboro to neighboring homes across the creek. There is nothing to stop the patients from doing the same thing. For most of the year, the creek is easily passable, and the woods are dotted with deer trails that lead to other adjoining properties.
The directors of Garrett Space frequently use the Ozone House and Dawn Farms as analogous examples of residential treatment facility. These facilities are licensed and follow state protocol; however, online reviews report patients leave and go missing with some regularity. As a facility housing adults, patients can come and go on their own volition.
There is no stated plan for dealing with substance abuse or weapons. Will this be a sober living facility? The directors only offer the assurance that it "these are good kids."

Garrett's Space is underfunded.
The founders say they need another $6,000,000 for a full build out.
The founders said, a year ago, they anticipate up to $2,000,000 annually to operate. Inflation has likely increased this number greatly.
As an unlicensed and nonmedical facility, they will be unlikely to use health insurance or Medicaid to fund operating costs. Who are they going to serve? How long will they be able to maintain a sliding scale? This is an expensive 24-7 operation.

Density of Use
They do not say how many day users they anticipate in zoning application. They are going to need to see a lot of patients to cover costs. They say they will have 30 users at a time but do not say if day users will be coming and going throughout the day. They also anticipate family visits.
This is a transient use of the property. Residential housing adds stability to the neighborhood. This will have the opposite effect.
3900 N. Dixboro has been on and off the market for almost a decade. No developer has figured out a way to make a residential redevelopment pencil out. Substantial wetlands, slopes and woodlands limit developable land.
According to the zoning application, there is no conservation easement shown on any map.

Garrett's Space states that the facility will not be visible to nearby residents. This is a fallacy. The house and barn are readily visible now to many adjacent neighbors and the new facility is unlikely to be shielded from view.
Noise and light pollution are real considerations. Any nighttime activities will shed light that will be visible to neighboring houses. Based on the location of housing, sound travels now and will be a real concern with a higher density of use.
The proposed 11,000 square foot facility does not look residential. It looks like an institutional group home.
Garrett's Space claims they will have a conservation easement to buffer the area. They do not have an easement in the rezoning application. No wetlands are developable, no matter what the use is at 3900 N. Dixboro and should they not be considered part of a conservation easement.

Rezoning this property sets a terrible precedent for the township. There are several large lot estates and big farms in rural areas of the township.
Ignoring the Master Plan in order to allow this will have a snowball effect and we can expect other developers, quasi -medical service facilities and others to see this area ripe for redevelopment.
There are other locations for a facility like this that do not abut a residential neighborhood.

The neighborhood adjoining 3900 N. Dixboro is an active, vibrant neighborhood. We have annual get togethers, Halloween hayrides and an active email group. We have a long history of helping one another. As taxpayers and voters, not only have we put our faith in our elected officials honoring our Master Plan, but we have also been paying into a legal fund to defend it. This project is not in keeping with the Master Plan. This unlicensed and untested facility is not suitable for a residential area. We opposed this rezoning and count on our elected official to enforce our Master Plan and truly keep our township Superior.

Sincerely,
Kritika Versha
Date: 04/15/2023
Address:
6525 Warren Rd
Ann Arbor
MI - 48105

STUDENT LIFE
UNIVERSITY HEALTH SERVICE
UNIVERSITY OF MICHIGAN

April 14, 2023

To Whom It May Concern,

I write to express my enthusiastic support for the development of Garrett's Space in Superior Township. As a Washtenaw County resident and local mental health expert, I believe this project is an important addition to the social fabric of our community and will contribute to heathier and happier citizens.

At the University of Michigan and at Eastern Michigan University where I have worked with students, staff, faculty, and community members over the past 14 years, I have come to understand the critical role of safety nets for our community members. There are so many barriers (personal, financial, logistical, stigma) to accessing mental health care and support. Garrett's Space will reduce barriers and strengthen that safety net for young people in our community.

Recovery from mental health struggles requires connection, community, and a holistic approach. As the Chief Mental Health Officer for Student Life at the University of Michigan, I have seen firsthand how many young people suffer from loneliness, isolation and stigma about help seeking. One of the features of Garrett's Space that is especially compelling is the beautiful setting and the emphasis on nature, wellness programming and creativity. When the vision is realized, Garrett's Space will be a very special place that benefits our entire community.

Please support the development of this project. Thank you very much for your time and consideration.

Sincerely,

Lindsey Mortenson, M.D.

Lindsey Mortenson, M.D.
Chief Mental Health Officer, Student Life
Associate Executive Director, University Health Service
Clinical Assistant Professor of Psychiatry

On Apr 17, 2023, at 9:44 AM, Loren Levy <lorenl@umich.edu> wrote:

> You don't often get email from lorenl@umich.edu. Learn why this is important

Dear Ms Findley and fellow trustees,

We live in the Tanglewood subdivision, less than one mile from the planned location for Garrett's House. I fully support allowing this facility to use the property as proposed. Mental health issues including depression, anxiety and suicide are rampant, especially among young adults for many reasons. As a society we need to recognize mental health IS physical health and not continue the stigmatization of those suffering.

We are not concerned that there will be a significant impact on traffic, noise or pollution (?) as the group "Smallgroupofneighbors.org" would like to suggest. There is already a relatively new large church right in that area which has not had a noticeable impact on any of the above. Those neighbors concerned about their children need to understand that the people to be helped at this center are no different from their children, and odds are good that at least some of their own children will need and benefit from the treatment offered there.

Please consider the potential for good that may come from this project and allow Garrett's House to proceed as planned.

Thank you for your consideration,

Loren Levy. M.D.
Steven Mandell, M.D.
5524 Overbrook Dr
Ann Arbor, MI 48105

On Apr 14, 2023, at 4:27 PM, Margaret Whittier-Ferguson <margaretwf27@gmail.com> wrote:

> You don't often get email from margaretwf27@gmail.com. Learn why this is important

Hello,

My name is Margaret Whittier-Ferguson, and I was born and raised in Ann Arbor, Michigan. I am writing in support of Garrett's Space, and the non-medical residential space they are planning to develop.

It feels correct to begin with how I know of Garrett's Space. I feel truly honored to have called Garrett Halpert--the namesake and inspiration for this truly incredible program for young people--a dear, old friend. We went to preschool together, but really became friends when we both attended Tappan Middle School. I knew Garrett as warm, goofy, easy-to-be around, and, as a friend who, like me, struggled with mental health. Given the lack of available mental health resources (an organization like Garrett's Space, for instance), I found we often provided necessary mental health support to one another. This was not an isolated experience I had; I found many of my friends were struggling in ways that none of us, as middle schoolers, as high schoolers, were equipped to deal with. Even those of us lucky enough to have therapists often needed more consistent wrap-around services. It is devastating to me, and should be to the broader Ann Arbor community, that Garrett is not the only friend, only critical member of our community, that we've lost to suicide. Two other friends of mine from Ann Arbor have committed suicide (that I know of). These deaths struck our community incredibly hard, and have had a lasting impact on both our community, and my own mental health. As someone who experiences severe depression, when I find myself spiraling into suicidal ideation, I find that my own life, my own struggle to have a sense of safety and care, is intimately linked to the *lack* of safety and care that ultimately led to my friends' inability to cope with life's numerous stressors. What does the expansion of Garrett's Space mean for the Ann Arbor community? It means young people like me, like Garrett, will have broader access to care and safety: It will save lives.

As someone who has struggled with mental health since before I can remember, I feel it is also worth including what precisely about this project that I believe is necessary and exciting. I have been hospitalized (under section 12) four times. While three of these hospitalizations have been at adequate facilities, and I am grateful for the relatively safe environment they provided as a "holding ground" during a crisis, the fourth was further traumatizing. Making the choice to go to the hospital (or being explicitly told by a provider that either I voluntarily go, or the police will get involved) is not an easy one. Each time, I have thought to myself, "What if there had been something, somewhere, some program that I could have had access to *before* it got to this point?" I see this expansion of Garrett's Space as providing that necessary preventative care that so many young people desperately need. The kind of care that keeps young people out of in-patient hospital settings. While in-patient units can ideally provide critical care during an escalated crisis, they are not ultimately places equipped to heal those of us struggling in a lasting way.

Last Spring, after multiple hospitalizations, I ended up at Austen Riggs in Western Massachusetts, a long-term residential psychiatric treatment center, where I stayed for 5 months. While I was provided with extensive care, the cost of this treatment was staggering, and the length of stay meant I was ripped away from my home, support systems, and local providers, in a way that Garrett's Space is intentionally trying to avoid by having young people

stay for 3 to 4 weeks. To be clear: Garrett's Space is not proposing this kind of residential long-term type of program, nor are they proposing a site for hospitalization during acute crises. Garrett's Space is proposing providing holistic care at a level where there is a massive vacuum of programs. This proposal is intervening at arguably one of the *most* critical times in terms of suicide prevention; before it gets so bad a young person needs to make that impossible choice of checking themselves into a hospital, or being forced to do so.

The most impactful aspects of my stay at Austen Riggs was not tweaking medications, but rather coming together with other patients in intentional ways. I was able to work on a weaving project in an art studio as other patients painted and made pottery around me. These "patients" I'd like to remind all of us, were other young people, struggling in similar and different ways to me. These struggling young people are not dangerous or violent, rather they, we, are struggling and desperately need love, support, and care from a program like Garrett's Space. Whether you are a permanent resident of the adjacent properties, or are a young person seeking life-saving, short-term support at the proposed Garrett's Space site, we all deserve care.

Yes, other patients at Austen Riggs and I would connect about shared mental health struggles, but we'd also connect through being supported by practitioners trained in breathing and yoga practices. We'd connect about what we noticed as we walked through the woods together. We'd connect about the small (and large) glimmers of hope in the world around us. These connections and this hope, through a holistic model, are what this proposal is aiming to nurture.

While I am trying to understand concerns of having such a facility as a neighbor, or in the community, given the urgent and persistent nature of the mental health crisis, I am disheartened and concerned that it is not immediately evident that *having* a facility like this is a way to minimize traumatic events (namely the suicides of young people) in our community. According to one national survey, 70% of young adults ages 18-24 reported being moderately to severely depressed. It's worth, I think, taking a moment to think of 70% of the young people that you know personally. Some of us who experience moderate to severe depression present as such. But many of us have been taught by institutions, by people in our lives, by the world we live in, that it is better to mask that depression, attempt to push it away. This approach only works for so long, and I would end by asking what I believe is a key question: would the broader Ann Arbor community rather continue to push away the realities of the mental health crisis, or support a safe, holistic environment for young people to reactivate their will to live?

I hope you take my contribution in mind. I urgently support the inspiring, humbling, and necessary efforts of Garrett's Space to expand their programming, and I urge you to do the same.

In whole-hearted support,

Margaret Whittier-Ferguson
margaretwf27@gmail.com
--

Margaret Whittier-Ferguson
margaretwf27@gmail.com
734-546-0552

On Apr 17, 2023, at 10:40 AM, Benz, Marsha <marshua@med.umich.edu> wrote:

> Some people who received this message don't often get email from marshua@med.umich.edu. Learn why this is important

Hi,
I work in the mental health field. Suicidal ideation and worse, young people taking their own lives, is not uncommon in our community. There is no evidence that depressed/anxious young people will be a threat to neighbors. They are a threat to themselves. When you support these young people, you support your community, your own family and friends and help to make the Ann Arbor area a more supportive environment for those who need it.
Please support the rezoning and purchase of the property for Garrett's Space. Marsha Benz

If you offer appointments, be someone worth going to see. If you do home visits, be someone you would let in the house. If you see mandated clients, be a relief. Helen Mentha (2020)

Marsha Benz | MPH, MA (she/her)
Wolverine Wellness
Assistant Director, Wellness Coaching and Wellbeing Academy
Member of the Motivational Interviewing Network of Trainers (MINT)
marshua@umich.edu | 734.647.4656

STUDENT LIFE
WOLVERINE WELLNESS
UNIVERSITY OF MICHIGAN

On Apr 17, 2023, at 2:08 PM, Mary D'Alessandro <spiceymary@comcast.net> wrote:

> You don't often get email from spiceymary@comcast.net. Learn why this is important

Hello
Please find my concerns when it comes to Garrett's place.

Thank you
Mary D'Alessandro
---------- Original Message ----------
From: Mary D'Alessandro <spiceymary@comcast.net>
To: "fdalessandro@comcast.net" <fdalessandro@comcast.net>
Date: 04/17/2023 1:26 PM
Subject: Questions

For the proposed project- it is very vague.

What specific licensing would it have for patient safety and care?
Are the patients free to come and go? Check themselves out?
What specific health treatments are they addressing?
Are all of the patients from all care allowed to intermingle? Are there restrictions to this?
For psychiatric care- is the program offering evidence-based care? (best practices approach)
What would the ratio of staff to patient be? the same across all care programs?
Would each health issue be dealt with specifically thru proven methods based on individual? Or a generalization to the group?
Is there a limited length of stay? After stay, will they be participating in out-patient?
Maximum amount of in house and outpatient patients?

How do you evaluate if your program was effective? If this is the first in the country, what do you base your future predictions on?
What was the improvement across all treatments? If some treatments were ineffective- will those programs be discontinued?
How will the community know which was a success or not? When are new ones added?

What kind of testing is taken upon entering facility? Is there a specialized testing that your facility will put in place for entering and leaving the facility?
Will female and male be separated? What is feel comfortable in single gender program? Offered?
What ages are you accepting? Children?
Does the patient have a say as to what type of treatment? Group? Individual? Sport?
Does the family have a say?

What specific health issues will be dealt with?

Socializing on weekends? how are patients encouraged to do this? Can they leave the property?
Will there be a board? Advisory board?

Zoning? Soil appropriate? Easements needed?
Are there certain zoning requirements? Eg. per square feet per type of centre?
What type of animals? garden?
What specific protocols are in place should a patient(s) have an out-of-control episode?
How will residents be notified if there are such safety issues?
Will there be on-site security? Gated?
How many medical staff on-site?
Is it for Michigan residents? Washtenaw community? National?
How much of a tax burden will this be? What percentage of our tax will go up?
Will insurance be able to cover costs of facility/ care?

Thank you
Mary D'Alessandro

From: Michael Dubin <mdubin71@gmail.com>
Sent: Thursday, April 13, 2023 3:15 PM
To: Lynette Findley <lynettefindley@superior-twp.org>; planning@superior-township.org
Subject: Garrett's Space

Dear Board of Trustees and Planning Commission

As a resident of Superior Township who lives adjacent to the property being considered for rezoning, I am writing to oppose the rezoning of 3900 N. Dixboro Rd for a residential and day treatment center for anxious, depressed and suicidal adults.

On March 31st, a mere 2 weeks ago, while submitting an MNRTF grant application, the Superior Township Board of Trustees declared in resolution number 2023-21: "Whereas The preservation of open spaces in Superior Township enjoys wide public support and is critical to the survival of sensitive ecosystems in the Township" and yet here we are considering rezoning A-2 zoned residential land into a planned urban development adjacent and surrounded by neighbors and landowners that are universally opposed to it. It is not even close to the character of the surrounding area and If this facility fails, it will have scarred the landscape with a 50 car parking lot and a facility that can only be used for future commercial use as a transient stay community, a hotel, or a medical facility. How is this in character with its surroundings, our zoning ordinance, or our master plan. We do hope that the planning commission and the board of trustees will take into account the fact that all of the immediately adjacent neighbors (and many more) are opposed!

We have learned that this facility will not be licensed and will basically be run as a short term hotel for those with depression and anxiety. Garrett's Space, while noble in their desire to help, have no experience in running any kind of overnight facility, and no plan in place for security or emergencies. In addition, they are severely under funded for their ambitions.

I was personally involved in a "manhunt" when a family member with depression walked away from a mental health day facility where they were supposed to be attending an in person mental health session. The surrounding dense woods will make for difficult searches when things like this happen, and it will be traumatic for both the family members and immediately adjacent community members, regardless of outcome. Both Ozone House and Dawn Farms report events like these from time to time. This will undoubtedly happen.

This facility is adjacent to many neighbors who universally oppose changing the character of the neighborhood. One that is purely residential without commercial enterprises of any kind. Why would a township board want to change that?

This property is literally right next to the highway with considerable highway noise pollution above 50 decibels at **all** times. Highway noise pollution, according to multiple US and international studies, is harmful for mental health, anxiety and depression. Even if you are in support of a facility like this, this is the EXACT wrong place to put it.

Rezoning this property sets a precedent for the township that will raise the expectations of other developers who will see Superior Township as ripe for development and open it to the possibility of lawsuits if denied, due to precedent. I thought Superior Township has historically prized it's residential and country feel without commercial development next to its residents. That is why we moved here. Why do we want to change that?

We deeply hope that our elected officials will respect the concerns and interests of its residents close to this property.

Respectfully,

Michael Dubin

Superior Township resident

On Apr 15, 2023, at 8:55 PM, Patrick White <whitepat@umich.edu> wrote:
>
>
> The Superior Township Board of Trustees
> C/O Lynette Findley, Clerk
> 3040 North Prospect
> Superior Township, MI 48198
>
> Dear Trustees
>
> As a resident of Superior Township, I am writing to oppose the rezoning of 3900 N. Dixboro for a residential treatment center for anxious, depressed and suicidal adults.
>
> While I broadly support alternative treatment for mental health care, this particular facility at this specific site is a liability to the adjacent neighborhood and the entire township.
>
> In order to skirt the zoning ordinance language, we have learned this facility will not be licensed. This is unlicensed transient housing.
> Lack of licensure and lack of specificity in the zoning application gives Garrett's Space wide latitude to do what they please. For example, despite Garrett's Space's stated mission to treat adults age 18 to 28; this is not included in the zoning application and will give them the ability to house any adult there. Similarly, Garrett's Space directors have expressed the desire to house those immediately released from the hospital following a suicide attempt. Although they no longer propose this on their website, there is nothing in the zoning language that would stop this usage. Length of stay, number of patients, staffing and usage are in a constant state of flux.
> Zoning goes with the land. What will this facility become if Garrett's Space fails?
> This lack of licensure is a blank check to do as they please; this is an unregulated facility.
>
> Additionally, while Garrett's Space offers many statistics, they do not provide any peer reviewed research to prove the facility will accomplish its goals. They provide only anecdotal evidence. They pride themselves on being the first of its kind anywhere. This is an experiment.
> They say they will attempt to screen out those with imminently suicidal, those with psychosis or mania or who represent a danger to others. There are multiple studies that show psychological misdiagnosis is a common occurrence. Many psychological illnesses change presentation with time. There is no way to prevent some degree of misdiagnosis.
> The organization has no history of in-patient treatment. Most of their therapy is online group therapy.
> There are no standards of care for a facility like this.
>
> As nearby residents, we have many security concerns; both for our own safety and those of patients at the facility.
> The directors of Garrett's Space have not publicly addressed any security issues.
> There will only be 2 employees overnight securing 75 acres and 20 mood disordered, suicidal people in a coed facility. How will they keep the people there secure from intruders and from one another and from themselves?
> The site lacks secure boundaries. Dennis Serras, deceased owner of the property frequently walked from his home at 3900 Dixboro to neighboring homes across the creek. There is nothing to stop the patients from doing the same thing. For most of the year, the creek is easily passable, and the woods are dotted with deer trails that lead to other adjoining properties.

> The directors of Garrett Space frequently use the Ozone House and Dawn Farms as analogous examples of residential treatment facility. These facilities are licensed and follow state protocol; however, online reviews report patients leave and go missing with some regularity. As a facility housing adults, patients can come and go on their own volition.
> There is no stated plan for dealing with substance abuse or weapons. Will this be a sober living facility? The directors only offer the assurance that it “these are good kids.”
>
>
> Garrett’s Space is underfunded.
> The founders say they need another $6,000,000 for a full build out.
> The founders said, a year ago, they anticipate up to $2,000,000 annually to operate. Inflation has likely increased this number greatly.
> As an unlicensed and nonmedical facility, they will be unlikely to use health insurance or Medicaid to fund operating costs. Who are they going to serve? How long will they be able to maintain a sliding scale? This is an expensive 24-7 operation.
>
> Density of Use
> They do not say how many day users they anticipate in zoning application. They are going to need to see a lot of patients to cover costs. They say they will have 30 users at a time but do not say if day users will be coming and going throughout the day. They also anticipate family visits.
> This is a transient use of the property. Residential housing adds stability to the neighborhood. This will have the opposite effect.
> 3900 N. Dixboro has been on and off the market for almost a decade. No developer has figured out a way to make a residential redevelopment pencil out. Substantial wetlands, slopes and woodlands limit developable land.
> According to the zoning application, there is no conservation easement shown on any map.
>
> Garrett’s Space states that the facility will not be visible to nearby residents. This is a fallacy. The house and barn are readily visible now to many adjacent neighbors and the new facility is unlikely to be shielded from view.
> Noise and light pollution are real considerations. Any nighttime activities will shed light that will be visible to neighboring houses. Based on the location of housing, sound travels now and will be a real concern with a higher density of use.
> The proposed 11,000 square foot facility does not look residential. It looks like an institutional group home.
> Garrett’s Space claims they will have a conservation easement to buffer the area. They do not have an easement in the rezoning application. No wetlands are developable, no matter what the use is at 3900 N. Dixboro and should they not be considered part of a conservation easement.
>
> Rezoning this property sets a terrible precedent for the township. There are several large lot estates and big farms in rural areas of the township.
> Ignoring the Master Plan in order to allow this will have a snowball effect and we can expect other developers, quasi -medical service facilities and others to see this area ripe for redevelopment.
> There are other locations for a facility like this that do not abut a residential neighborhood.
>
> The neighborhood adjoining 3900 N. Dixboro is an active, vibrant neighborhood. We have annual get togethers, Halloween hayrides and an active email group. We have a long history of helping one another. As taxpayers and voters, not only have we put our faith in our elected officials honoring our Master Plan,

but we have also been paying into a legal fund to defend it. This project is not in keeping with the Master Plan. This unlicensed and untested facility is not suitable for a residential area. We opposed this rezoning and count on our elected official to enforce our Master Plan and truly keep our township Superior.
>
> Sincerely,
>
> Patrick White
> 4-15-23
>
> 6525 Warren Rd
> Ann Arbor MI
> 48105

From: Paul Guttman <pguttman@umich.edu>
Sent: Thursday, April 13, 2023 9:05 PM
To: Lynette Findley <lynettefindley@superior-twp.org>; Laura Bennett <planning@superior-twp.org>
Cc: scott@garretsspace.org
Subject: Support for Garrett's Space

I am a longtime Ann Arborite (My family moved to Ann Arbor in 1960) and currently a resident of the Fleming Creek II subdivision located at the corner of Dixboro and Plymouth Roads. I fully support the rezoning of the Serras property in Superior Township. Behavioral health issues are treatable and having a facility where folks in our community can go for this assistance is critical. I am hoping to attend the Trustee meeting on April 17th to show my support, but will be out of state on the 26th.

Paul Guttman
4957 S Ridgeside Circle
Ann Arbor, Mi 48105
pguttman@umich.edu

On Apr 17, 2023, at 6:26 PM, Rob Dobrusin <robdobrusin@gmail.com> wrote:

> You don't often get email from robdobrusin@gmail.com. Learn why this is important

Dear Ms. Findley:

I am writing in support of the rezoning proposal concerning Garrett's Space.

In my capacity as rabbi of Beth Israel Congregation for 30 years, as a parent and as a concerned resident of Washtenaw County, I am well aware of the serious issues facing the young people in this community and the drastic need for support services for those young people who are confronting issues of depression and anxiety. I have watched as Julie and Scott Halpert and those who work with them have developed Garrett's Space into a much needed service to the young people in our community and their families. The dedication and commitment of those involved with Garrett's Space is a tremendous asset to this community.

I believe the establishment of a residential space to provide a caring community for those young people who face these difficult life situations is essential for this community. The space that is envisioned will provide a tranquil and supportive environment and will make a vital and life-saving difference for these individuals.

I completely support this vision and believe that to turn away from the opportunity to help those in such dire need would be shortsighted and harmful to so many. I completely support this plan for Garrett's Space and hope that the project can move forward.

Thank you for your time.
Rabbi Robert Dobrusin
Rabbi Emeritus, Beth Israel Congregation
Ann Arbor

On Apr 16, 2023, at 9:16 AM, Rafal Farjo <rfarjo@gmail.com> wrote:

> Some people who received this message don't often get email from rfarjo@gmail.com. Learn why this is important

Dear Mr. Schwartz and Superior Township Trustees,

I am writing to voice my **strong opposition** to the proposed rezoning of 3900 Dixboro Road. I have been a resident of Superior Township for 41 years and currently reside on Overbrook Drive less than 0.5 miles from this property. The proposed use of this land certainly does not fit with the current residential and agricultural districts in this area and it is quite strange that the township is even considering this rezoning. I vehemently echo the same safety concerns raised by others and hope the township realizes the legal liabilities this rezoning could bring should there be any future conduct or safety issues. I strongly urge you to listen to the will of those who actually reside in Superior Township rather than the supportive letters sent by others who do not live here with us. Regardless of the good mission for the desired use, this facility does not fit with the long-term planning/zoning developed for our community that we all value and respect.

Best,
Rafal Farjo, Ph.D.
5210 Overbrook Drive
Ann Arbor, MI 48105
rfarjo@gmail.com

From: Roann Altman <roann@umich.edu>
Sent: Friday, April 14, 2023 12:09 PM
To: Lynette Findley <lynettefindley@superior-twp.org>; Laura Bennett <planning@superior-twp.org>
Cc: Scott Halpert <scott@garrettsspace.org>
Subject: Garrett's Space Rezoning Request

Greetings, everyone.

As a resident of Superior Township, I am writing this letter in strong support of the application to rezone a township property to accommodate Garrett's Space.

I relocated from Ann Arbor to Superior Township nearly twenty years ago, drawn to the area for its natural beauty and open spaces. Soon after arriving, I reviewed the Master Plan and was delighted to see its forward-looking vision to preserve the rural nature of the township.

When I learned that a potential property had recently been located to serve as a residential center for Garrett's Space, I was thrilled. I thought it would be a wonderful setting for at-risk young adults to reside. The center could provide the critical professional and peer-level support they needed at a most difficult time in their lives. And the natural surroundings would certainly enhance their healing journeys.

I then learned that objections had been raised by some of the neighbors adjacent to the property. Of course, being so close to the center, they would be the ones most vulnerable to whatever may happen. But conversations with others have indicated that the population of concern will not pose a danger to those in the area, particularly because they will have been screened before admittance and monitored thereafter.

At this juncture, it is crucial to continue to respect the vision and goals of the Master Plan, honor those coming forward with objections, and look beyond ourselves to what can be created to serve a higher good. The property under contract would be ideal for the creation of this residential center. Just being able to be out in nature would be healing for the body, mind, and spirit. I know that those involved with the project thus far have strived to balance out the concerns of the neighbors with the needs of the center. Should there be any additional concerns, I am confident they can and will be addressed.

I do hope that we find the collective will to do something good for these at-risk youth and for the township. The center as designed will have a very low impact on land use. By rebuilding social infrastructure for a group that often feels lonely and isolated, the owners will be creating positive energy for the township. They have already taken on the responsibility to help others. Let us help them move on with their vision to bring healing to young lives. It will be something we, too, can be proud of.

Sincerely,

Roann Altman

From: Russman, Daniel <DRussman26@gsb.columbia.edu>
Sent: Thursday, April 13, 2023 10:04 AM
To: Laura Bennett <planning@superior-twp.org>; Lynette Findley <lynettefindley@superior-twp.org>
Subject: Please Consider Rezoning for Garrett's Space

Hi Lynette and the planning commission,

Please consider rezoning the Super Township property so we can make Garrett's space a refuge for troubled young adults. Be on the right side of history and choose to support Garrett's space, as opposed to continuing to perpetuate stigma around mental health that is detrimental to the health and wellness of our nation. Garrett was a close friend of mine and was a danger to no one but himself. He deserved and the current and future generations of young adults deserve to have a space available to them to help on their path. Thanks for all your support on this.

Best,
Daniel

Daniel Russman
PhD Student | Consumer Behavior (Marketing)
Columbia Business School | New York, NY
DRussman26@GSB.Columbia.edu

On Apr 17, 2023, at 9:12 AM, Sanne Krummel <sanne_krummel@mac.com> wrote:

Dear Lynette Findley, Dear Planning Commission, April 17, 2023

I am reaching out to you as a concerned citizen to express my support for Garrett's Space. I understand there has been some controversy around their acquisition of land, and I just wanted to add my voice to the chorus of voices calling for approval of this vital space for our young people.

Far too many young adults struggle with mental health challenges. Nationally, 70% of teens are estimated to be struggling with depression and anxiety. Suicide is the leading cause of death among youth and young adults in Michigan. *What are we to do about this?*

Julie and Scott Halpert, Garrett's parents, have worked tirelessly to build the kind of programming and holistic space that young people like Garrett, their son, could have benefitted from: **a serene, healing place where they are seen, heard and welcomed**; where their sensitivity can be explored, not as a burden, but as a gift. It breaks my heart to hear that, out of concern for property values and unsubstantiated fear, a few angry neighbors would seek to keep a mission like this from moving forward. What does that tell our young people about their place among us? What does that say about their future?

Our world seems to be in crisis right now— politically, socially, economically, interpersonally, spiritually. Not a realm is untouched. It's no wonder so many young adults feel hopeless and overwhelmed. We need to build people up. We need healing, community, restoration, peace, activism, support. These neighbors who rally against "delinquents" infiltrating their neighborhood, don't understand that people struggling with depression and anxiety are people just like them, trying to make sense of their world. And while they may not have a son, daughter, brother, sister, friend who is in need of help right now, the likelihood that their loved ones will one day be in need of services is very likely.

Thank you for your public service, and for listening to our voices.

With appreciation,

Sanne Krummel

Resident near the intersection of Dixboro Road and Plymouth Road

April 13, 2023

To Whom It May Concern:

I purchased my house at 5765 Becky Ln, Ann Arbor, before I met my husband. I instantly envisioned a family as I walked through the walls of the house. Now that I am married with three young sons, that vision has certainly come to life. We are thankful that our boys live in a residential environment with sprawling lands and wildlife. Given the residential zoning in place, I did not think it would be a possibility for a project such as Garrett's Space to be built in our community. Indeed, the master zoning plan prohibits such a building.

On behalf of my family, I am writing to help to ensure that what I envisioned remains for my family. Please preserve the current master plan zoning restrictions from being disrupted.

Sincerely,

Shabnam Shidfar

5765 Becky Ln

Ann Arbor, MI

Ph: 734-262-4481

WASHTENAW COUNTY
OFFICE OF THE SHERIFF

2201 Hogback Road ◆ Ann Arbor, Michigan 48105-9732 ◆ OFFICE (734) 971-8400 ◆ FAX (734) 973-4624 ◆ EMAIL sheriffinfo@ewashtenaw.org

JERRY L. CLAYTON
SHERIFF

MARK A. PTASZEK
UNDERSHERIFF

April 17, 2023

Re: Support for Garrett's Place

Dear Superior Township Supervisor Schwartz, Clerk Findley, Treasurer Lewis, Board of Trustees and Planning Commission Members,

As Sheriff of Washtenaw County, I am deeply concerned with the welfare and wellness of all of the residents of Washtenaw County. Currently, I am very much aware that our young people are experiencing heightened levels of trauma, anxiety and tragically even suicide. I believe that we all care deeply about our young people and want to help them grow into productive and happy adults. Garrett's Space is dedicated to providing the support that our young people and young adults need to deal with their mental health challenges and thrive. It is an Ann Arbor based suicide prevention nonprofit working to restore hope by promoting connections, self-worth and resilience."

I believe that Garrett's Space is a good fit for Superior Township with its desire to develop, but also preserve nature and natural settings. Garett's Space would create a supportive, healing environment where the young adults can receive and give support and know that they are not alone in their journeys. Services would include wraparound support, group, art and music therapies, and wellness activities, inclusive but not limited to poetry workshops, yoga and health cooking.

Garret's Space would serve the young people of Washtenaw County including the families and children of Superior Township residents. Part of our mission is to make our residents safer and improve their quality of life. I believe Garrett's Space would contribute to that mission and I urge you to approve Garret Space Area Plan Application and Rezoning for Planned Community Use at 3900 N. Dixboro Road, Ann Arbor, MI, 48105.

Sincerely,

Sheriff Jerry L. Clayton

On Apr 17, 2023, at 1:15 PM, Steve Opaleski <sljo@hotmail.com> wrote:

> Some people who received this message don't often get email from sljo@hotmail.com. Learn why this is important

I am writing to express both my wife and my disapproval of any rezoning for medical use at 3900 Dixboro Road.

I have been a resident of Superior Township for the past 5 years, moving here in part because of the township's Master Plan, keeping the areas north of Geddes rural. Although still on a large parcel, a multi-resident medical facility at 3900 N Dixboro is not in line with this Master Plan.

There are plenty of other locations within Washtenaw County for which this proposed facility would be appropriate.

It seems like the Township is continually getting requests and proposals to rezone away from the master plan, such as this proposal and the previous proposal for a sports complex at Plymouth and Ford Roads. You resisted the sports complex and now we implore you do to the same with this proposal.

If this note is posted publicly or included in meeting packets, please do not include our personal information.

Steve and Lenna Opaleski
Township Residents living less than 1 mile from 3900 Dixboro Road

From: Susan Mayman <smayman@verizon.net>
Sent: Thursday, April 13, 2023 9:33 AM
To: Lynette Findley <lynettefindley@superior-twp.org>
Subject: Support for Garrett's Space program

[You don't often get email from smayman@verizon.net. Learn why this is important at https://aka.ms/LearnAboutSenderIdentification]

Dear Ms Findlay- as long time friends of Julie and Scott Halpert and also supporters of the Garrett's Space Foundation, we are writing in support of the zoning application for the Garrett's Space program.

As parents of young adults we realize how vital such programming is and the need for such a unique non-medical residential program. I imagine the immediate neighbors in Superior Township realize this too and are clearly misinformed about the needs and characteristics of these young people.

We hope that the voices and needs of many will be heard at your hearing this coming week.
Sincerely
Susan and Todd Mayman

From: Teresa Ayers <taayers2@gmail.com>
Sent: Friday, April 14, 2023 9:46 AM
To: Lynette Findley <lynettefindley@superior-twp.org>
Cc: Laura Bennett <planning@superior-twp.org>
Subject: Letter of support for Garrett's Space

To Dr. Lynette Findley and members of the planning commission,

I am writing you today to voice my support for Garrett's Space and advocate for suicide prevention in our community from a professional and personal standpoint.

I have lived and worked in Superior township, primarily at Trinity Health Center/ St. Joe's, for over 25 years as an RN in the women's health field. I am currently retired and living in Scio township but am very concerned about the rising rates of suicide in the young adult population in Washtenaw County, which according to community health officials has doubled since 2017. In all of my years working in the medical field, I have never seen a more serious health care crisis and the total disconnect from proven scientific evidence in mental health treatment to the mental health model available in our country today. We actually know what works, there are proven programs and multiple studies but Hospitals are not consistently following scientific standards for care and depending on what hospital you get admitted to or what out patient provider you choose your treatment plan and management is a free for all, a total crap shoot, with no coordination of care between in-patient and out-patient care. I am fully aware that most of these problems are the direct result of insurance based reimbursement and the money making industry which is healthcare in America today. This has to change, and Garrett's Space certainly can not fix our broken health care system but it is a program that is backed by science and a mental health model that will save lives for the young people in our community that are seeking real solutions for their mental health struggles. Voting for Garrett's Space to move forward is one small step that will provide a different approach, a scientifically proven model, to effect change in the health and wellness of our young adult population in an increasingly isolating, lonely world.

I also have a very personal connection to my heartfelt support for Garrett's Space. In October of 2021, just 18 months ago, I lost my daughter, Sarah, to suicide after a long struggle with depression, following a sexual assault at MSU her junior year. Sarah went on to finish her degree, while also reporting her assault, in what turned into a year long investigation, which the university dropped after the assailant graduated. The judicial system failed my daughter and then our mental health system failed her. She deserved better and our young adults deserve better, we can't wait any longer to do something about this crisis.
PTSD and depression are treatable diseases, that have been successfully treated in other countries, without nearly as many lives lost to suicide. I know a center like Garrett's Space could have made the difference in my daughters life, the program they are planning is exactly what she was looking for, but it doesn't exist in Michigan and she didn't feel safe leaving the state without her family support system. Our young adults are increasingly struggling and isolated, they need a space they can be supported, with people they can relate to, that share similar lived experiences. Sarah was searching for more support outside her once weekly therapy sessions, she was attending a support group at safe house and a trauma based yoga program that really helped her. Sarah had very inconsistent support from physicians and no coordination of services between her therapist and physician, which is unheard of in the medical

treatment model. If she needed support after 5 pm, M- F, our only option was the Psychiatric ER, where twice we waited up to 24 hours to be evaluated. It is truly a nightmare and tragedy that this is what is considered normal for those seeking mental health care in our community today.

Sarah was a kind, generous, big hearted person. She loved working with children, working in elementary and early childhood education because she really wanted to make a difference in children's first educational experience. She was passionate about social justice issues, women's rights, and worked in her community as a volunteer. Working annually at the Lawton runathon to raise awareness and funding for children's cancer, after losing a classmate in her second grade classroom. She was truly the best of us, she had so many amazing plans for the future and wanted to live a full long life, even though she had a loving family, she felt alone and was tired of fighting against a system that really wasn't helping her at all.

I will be speaking at the planning committee meeting on April 26 but I am attaching a link to my daughters obituary as the tributes to her memory speak loudly to who Sarah was. She was loving and kind and the only way I can honor her now is to be her voice and try to do the right thing, which is to stand up for change. I would not wish the gut wrenching pain that comes from losing your own child to suicide on anyone, yet we literally have dozens of parents in our community that are grieving, just as I am and will be for the rest of my life. I hope that the elected officials in Superior township can see past the fears and hateful rhetoric of a few and vote for the wellbeing of the hundreds of young people that will be served by Garrett's Space in the future.

Thank you,
Teresa Ayers

https://www.niefuneralhomes.com/memorials/sarah-gallagher/4750724/

4.14.23

Dear Supervisor Schwartz, Clerk Findley, Treasurer Lewis, Honorable Trustees, and Honorable Planning Commission Members,

We are writing today to enthusiastically support Garrett's Space Area Plan Application and Rezoning for Planned Community Use at 3900 N. Dixboro Road, Ann Arbor, MI, 48105.

Garrett's Space is an Ann Arbor based suicide prevention nonprofit whose stated mission is "...dedicated to reducing suicides and filling critical gaps in supportive care options for young adults ages 18 to 28 facing mental health challenges. We are working to restore hope and perspective in this population by promoting connections, self worth and resilience."

Garrett's Space was founded out of tragedy in 2019 by Julie and Scott Halpert. In 2017, Mr. and Mrs. Halpert lost their son, Garrett, to suicide. From their personal tragedy has sprung an invaluable community resource.

Garrett's Space ultimate goal is to offer a local, residential option for young adults who are managing depression and anxiety. The vision is to create a supportive, healing environment in which the young adults can receive and give support and know that they are not alone in their journeys. Services will include wraparound support, group, art and music therapies, and wellness activities, inclusive but not limited to poetry workshops, yoga and health cooking. It should be noted that both the Halperts and the board members of Garrett's Space understand and recognize the importance of providing programming that is evidence-based.

Every day, in our collective work at the state level, it is clear that there is a severe lack of available resources to address mental health issues throughout our state. Having a local resource like Garrett's Space operate in our community would be invaluable. The ability for young adults to heal, grow, and recover in our community is critical. Plainly stated, we would be lucky to have this type of resource locally available for our young adults.

Thank you for allowing us to share our perspective on Garrett's Space and what it would mean for our community. We appreciate your consideration of this essential community resource.

In Service,

Sue Shink
State Senator, District 14

Jeff Irwin
State Senator, District 15

Jason Morgan
State Representative, District 23

Reggie Miller
State Representative, District 31

Jimmie Wilson, Jr
State Representative, District 32

Felicia Brabec
State Representative, District 33

Kathy Schmaltz
State Representative, District 46

Carrie Rheingans
State Representative, District 47

Jennifer Conlin
State Representative, District 48