

Supplemental material 1. Social network card 1 for assessing social network properties, in Korean and in English.

[사회연결망카드1]

| 구분 | 연번 | E1. E2-1. E2-2. 이름 | E2-3. 관계 | E3. 만 나이 | E4. 성별 | E5. 학력 | E6. 혹시 이분과 동거하고 계십니까? | E6-1. (비동거의 경우) 현재 거주지는 어디입니까? | E7. 알고 지낸 기간이 얼마나 되셨습니까? | E8. 이분과 얼마나 자주 이야기 하십니까? | E9. 이분과 직접 얼마나 자주 만나십니까? | E10. 이분과 얼마나 친하다고 생각하십니까? | E11. 건강에 문제가 있거나 건강과 관련한 중요한 결정을 할 때, 이분과 이야기하게 될 가능성이 얼마나 됩니까? |
|--------------------------------------|----|------------------------------|-------------|-------------|-----------|--------------------------|--|---|-----------------------------------|--------------------------------|---|---|---|
| | | 전체성함기록 [불가피한경우에만 애칭기록] | 관계보기 참조 | 만()세 | 추정 여부 | ①남 ②여 Ⓣ모름/ 응답거부 | ①초등(국민/소)학교 졸업 미만 ②초등(국민/소)학교 ③중학교 ④고등학교 ⑤대학교 ⑥대학원이상 Ⓣ모름/응답거부 | 추정 여부 | ①예 ②아니오 Ⓣ모름/ 응답거부 | ()년 | ①매일 ②일주일에 여러번 ③일주일에 한번 ④2주일에 한번 ⑤한달에 한번 ⑥일년에 여러번 ⑦일년에 한번 ⑧일년에 한번도 되지 않음 Ⓣ모름/응답거부 | ①매일 ②일주일에 여러번 ③일주일에 한번 ④2주일에 한번 ⑤한달에 한번 ⑥일년에 여러번 ⑦일년에 한번 ⑧일년에 한번도 되지 않음 Ⓣ모름/응답거부 | ①그리 친하지 않다 ②어느 정도 친하다 ③많이 친하다 ④아주 많이 친하다 Ⓣ모름/응답거부 |
| 배우자 | 1 | | 1 | | | | | | | | | | |
| 가장 자주 이야기하는 분들부터 순서대로 5명 | 2 | | | | | | | | | | | | |
| | 3 | | | | | | | | | | | | |
| | 4 | | | | | | | | | | | | |
| | 5 | | | | | | | | | | | | |
| | 6 | | | | | | | | | | | | |
| 가장 가깝고 중요한 1명 | 7 | | | | | | | | | | | | |

관 계 보 기

| | | | |
|-----------------------------------|---------------------------------------|-----------------|--|
| 1) 배우자 | 2) 애인 (10. 동네이웃, 11. 동네이웃이 아닌 친구와 다름) | 3) 친부모님 | 4) 시부모님 또는 장인/장모 |
| 5) 자녀 | 6) 자녀의 배우자 (사위 또는 며느리) | 7) 손자녀 | 8) 형제자매 |
| 9) 다른 친인척 | 10) 동네이웃 | 11) 동네이웃이 아닌 친구 | 12) 종교 활동을 통해 만난 분 (집사, 전도사, 목사, 신부, 스님 등) |
| 13) 의료기관 종사자(의사, 간호사, 상담사, 침쟁이 등) | | 14) 사회복지사 | 15) 기타 (누구인지 관계를 반드시 적을 것) |
| 98) 모름/응답거부 | | | |

[사회연결망카드2 : 사람들간의 관계]

| E12. 이름1과 이름2는 서로 얼마나 친하게 지냈습니까? | | | | | | | | | | E13. 이름1과 이름2는 얼마나 서로 자주 이야기를 합니까? | | | | | | | | | |
|---|----|--------|-----|--------------------------|---|---|---|---|---------------|--|----|--------|-----|--------------------------|---|---|---|---|---------------|
| 구분 | 연번 | 전체성함기록 | 배우자 | 가장 자주 이야기하는 분들부터 순서대로 5명 | | | | | 가장 가깝고 중요한 1명 | 구분 | 연번 | 전체성함기록 | 배우자 | 가장 자주 이야기하는 분들부터 순서대로 5명 | | | | | 가장 가깝고 중요한 1명 |
| | | | | 1 | 2 | 3 | 4 | 5 | | | | | | 6 | 7 | 1 | 2 | 3 | |
| 배우자 | 1 | | | | | | | | | 배우자 | 1 | | | | | | | | |
| 가장 자주 이야기하는 분들부터 순서대로 5명 | 2 | | | | | | | | | 가장 자주 이야기하는 분들부터 순서대로 5명 | 2 | | | | | | | | |
| | 3 | | | | | | | | | | 3 | | | | | | | | |
| | 4 | | | | | | | | | | 4 | | | | | | | | |
| | 5 | | | | | | | | | | 5 | | | | | | | | |
| | 6 | | | | | | | | | | 6 | | | | | | | | |
| 가장 가깝고 중요한 1명 | 7 | | | | | | | | | 가장 가깝고 중요한 1명 | 7 | | | | | | | | |
| ① 전혀 모른다 (E13은 생략하고, 다음 사람들 사이의 관계에 대하여 질문을 계속) ② 그리 친하지 않다 ③ 어느 정도 친하다 ④ 많이 친하다 ⑤ 아주 많이 친하다 ⑥ 모름/응답거부 | | | | | | | | | | ① 매일 ② 일주일에 여러번 ③ 일주일에 한번 ④ 2주일에 한번 ⑤ 한달에 한번 ⑥ 일년에 여러번 ⑦ 일년에 한번 ⑧ 일년에 한번도 되지 않음 ⑨ 모름/응답거부 | | | | | | | | | |

[Social network card 1]

| | | E1. E2-1. E2-2. Name | E2-3. Relation | E3. Age | E4. Sex | E5. Education level | E6. Are you living together with this person? | E6-1. (If not) Where does he/she live? | E7. How long have you known each other? | E8. How often do you talk to him/her? | E9. How often do you meet him/her? | E10. How close are you to him/her? | E11. How likely are you to talk to him when you have a health problem or make an important health decision? |
|--|---|--|---------------------|------------|---------------------------|---|--|--|--|--|--|--|--|
| | | Full name (If inevitable, write down nickname) | See relation legend | Age | ① Men ② Women Ⓢ N/A | ① Lower than elementary school ② Elementary school ③ Middle school ④ High school ⑤ Undergraduate school ⑥ Graduate school or higher Ⓢ N/A | ① Yes ② No Ⓢ N/A | ① Seoul ② Busan ③ Daegu ④ Incheon ⑤ Gwangju ⑥ Daejeon ⑦ Ulsan ⑧ Gyeonggi ⑨ Gangwon ⑩ Chungbuk ⑪ Chungnam ⑫ Jeonbuk ⑬ Jeonnam ⑭ Gyeongbuk ⑮ Gyeongnam ⑯ Jeju ⑰ Sejong ⑰ Aborad Ⓢ N/A | () years | ① Everyday ② Several times a week ③ Once a week ④ Once every 2 weeks ⑤ Once a month ⑥ Several times a year ⑦ Once a year ⑧ Less than once a year Ⓢ N/A | ① Everyday ② Several times a week ③ Once a week ④ Once every 2 weeks ⑤ Once a month ⑥ Several times a year ⑦ Once a year ⑧ Less than once a year Ⓢ N/A | ① Not very close. ② Somewhat close. ③ Close. ④ Very close. Ⓢ N/A | ① Very likely. ② Somewhat likely. ③ Not likely. Ⓢ N/A |
| Spouse | 1 | | | | 1 | | | | | | | | |
| People you frequently talk to, up to 5 people. | 2 | | | | | | | | | | | | |
| | 3 | | | | | | | | | | | | |
| | 4 | | | | | | | | | | | | |
| | 5 | | | | | | | | | | | | |
| | 6 | | | | | | | | | | | | |
| Closest individual to you, other than 1-6. | 7 | | | | | | | | | | | | |

Relation legend

- | | | | |
|-----------------------|--|--|-----------------------------------|
| 1) Spouse | 2) Boyfriend/girlfriend (exclude 10 or 11) | 3) Parents | 4) Father-in-law or mother-in-law |
| 5) Children | 6) Spouses of children | 7) Grandchildren | 8) Siblings |
| 9) Relatives | 10) Neighbors | 11) Friends other than neighbors | 12) Religious personnel |
| 13) Medical personnel | 14) Social workers | 15) Others (describe your relationship with him/her) | |
| 98) N/A | | | |

[Social network card 2]

| E12. How close are members of your social network to each other? | | | | | | | | | E13. How often do members of your social network talk to each other? | | | | | | | | | | | | | | | | | | |
|--|---|---|--------|--|---|---|---|---|--|--|--|---|--------|--|---|---|---|---|--|---|---|---|---|--|--|--|--|
| | | Full name (If inevitable, write down nickname) | Spouse | People you frequently talk to, up to 5 people. | | | | | Closest individual to you, other than 1-6. | | | Full name (If inevitable, write down nickname) | Spouse | People you frequently talk to, up to 5 people. | | | | | Closest individual to you, other than 1-6. | | | | | | | | |
| | | | | 1 | 2 | 3 | 4 | 5 | | | | | | 6 | 7 | 1 | 2 | 3 | | 4 | 5 | 6 | 7 | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Spouse | 1 | | | | | | | | | | Spouse | 1 | | | | | | | | | | | | | | | |
| People you frequently talk to, up to 5 people. | 2 | | | | | | | | | | People you frequently talk to, up to 5 people. | 2 | | | | | | | | | | | | | | | |
| | 3 | | | | | | | | | | | 3 | | | | | | | | | | | | | | | |
| | 4 | | | | | | | | | | | 4 | | | | | | | | | | | | | | | |
| | 5 | | | | | | | | | | | 5 | | | | | | | | | | | | | | | |
| | 6 | | | | | | | | | | | 6 | | | | | | | | | | | | | | | |
| Closest individual to you, other than 1-6. | 7 | | | | | | | | | | Closest individual to you, other than 1-6. | 7 | | | | | | | | | | | | | | | |
| ① They do not know each other (If so, skip E13). ② Not so close ③ Somewhat close ④ Close ⑤ Very close ⑥ N/A | | | | | | | | | ① Everyday ② Several times a week ③ Once a week ④ Once every 2 weeks ⑤ Once every month ⑥ Several times a year ⑦ Once a year ⑧ Less than once a year ⑨ N/A | | | | | | | | | | | | | | | | | | |

<Supplementary Material 2> Questionnaire and instructions for measuring social network size

※ Now we would like to ask you about the people with whom you interact. Before answering the following questions, think about people with whom you regularly interact. They can be a variety of people, including your spouse, family members, relatives, friends, neighbors, social workers, and priests.

E2. People often discuss important matters with others. ‘Important matters’ include good or bad things that had happened to you and your usual concerns. Looking back over the last year, with how many people have you discussed your important matters (including your spouse)?

Instructions

- Write down the number of “people with whom the respondent discusses important matters.”. There are no limits to this number.
- If the respondent responds that there are no such people, move on to E2-2. However, if the respondent responds that there were no important matters to be discussed with for the last year, ask “If you had those important matters, who would you like to discuss those matters with?”
- Check if spouses are one of the people with whom the respondent discusses important matters.

E2-1. Among the people you have mentioned above, think of up to 5 people with whom you most frequently talk. List the names of these people from most frequent to least frequent, excluding your spouse.

Instructions

- List up to five people in the blanks of E2-1, from the ‘most frequently talked to’ to ‘least frequently talked to’. The spouse of the respondent should not be included.
 - Even if the order of people is changed during the survey, fill in the blanks according to the first response of the respondents.
 - Encourage respondents to give the real names of the network members, and if they do not wish to give real names, encourage them to provide nicknames. Unspecified descriptions, such as ‘a friend’, ‘a son’, or ‘a daughter’, can make identification of network members difficult during follow-up evaluation, so at least try to specify them with unique nicknames or designating which son/daughter the network member is.
- ※ E2-1, E2-3 example) What is the name of the person you most frequently talk to?
If you do not want to give their real name, what is his/her nickname?

- Make sure the response is consistent with E2.
 - ※ Example 1) E2 = 5, including spouse > E2-1 = 4
 - Example 2) E2 = 3, not including spouse > E2-1 = 3
 - Example 3) E2 = 10, including spouse > E2-1 = 5

Supplemental Material 3. NCEP-ATP III criteria for metabolic syndrome.

| Components | Criteria |
|---------------------------------------|---|
| Central obesity (waist circumference) | Men: >90cm Women: >80cm |
| High serum triglycerides | ≥150mg/dL (1.7mmol/L) |
| Low high-density lipoproteins (HDL) | Men: <40mg/dL (1.03mmol/L) Women <50mg/dL (1.29mmol/L) |
| High resting blood pressure | Systolic≥130mmHg or diastolic≥85mmHg or on antihypertensive medication. |
| High fasting glucose | ≥100mg/dL (5.56mmol/L) or on antidiabetic medication. |

Supplemental Material 4. Examples of vigorous physical activities and moderate physical activities in accordance of The International Physical Activity Questionnaire Short Form (IPAQ-SF).

| Vigorous physical activities (Calorie consumption > 7 kcal/min) | Moderate physical activities (Calorie consumption 3.5-7 kcal/min) |
|--|--|
| Jogging or running, climbing, soccer, basketball, jump rope, singles tennis, squash, etc. | Volleyball, badminton, doubles tennis, table tennis, swimming, yoga, gymnastics, etc. |
| Mountain climbing, climbing stairs quickly | Walking down stairs or down hills |
| Inline skating, roller skating at high speed | Inline skating, roller skating lightly |
| Riding a bicycle fast (climbing a steep hill) | Riding a bicycle at normal speed (riding in a horizontal area or topography with some hills) |
| High-strength aerobics, step aerobics, swimming (continues to go around the track, similar to a swimming match) | Low-strength aerobics, aquarobics, fitness exercise, swimming (recreation) |
| Judo, taekwondo | Yoga, beauty gymnastics |
| Jump rope | Tumbling |
| Climbing stairs quickly (including machine use) | Light up-and-down exercise at home (including machine use) |
| Singles tennis, wheelchair tennis, squash, football, rugby, basketball | Table tennis, volleyball, doubles tennis, golf, badminton |
| Lifting heavy objects | Cleaning using hands and knees, washing dishes at a restaurant, carrying a slightly heavy object or child |
| Violent physical activity at work: rapid movement of the entire body, including running (ex: construction field labor) | Moderate physical activity at work: activities that require the use of arms and legs mainly and sometimes the entire body to be moved (ex: bus, tractor driving) |

Supplemental Material 5. Gender-specific association between social network properties and metabolic syndrome in the original dataset (N=9,717).

| Community-based low-risk participants (N=8,034) | | | | | | | |
|--|---------------------------|---------------|----------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Gender | Social network properties | No. of people | No. (%) metabolic syndrome | Model 1 ^a | Model 2 ^b | Model 3 ^c | Model 4 ^d |
| | | | | OR [95% CI] | OR [95% CI] | OR [95% CI] | OR [95% CI] |
| Men (n=2,790) | Size of social network | | | | | | |
| | Large (≥ 4) | 1,133 | 286 (25.24) | 1.00 | 1.00 | 1.00 | 1.00 |
| | Small (≤ 3) | 1,657 | 491 (29.63) | 1.23 [1.04, 1.47] | 1.22 [1.02, 1.45] | 1.20 [1.01, 1.43] | 1.17 [0.98, 1.40] |
| | per 1-unit decrease | | | 1.06 [1.01, 1.11] | 1.06 [1.01, 1.11] | 1.05 [1.00, 1.11] | 1.04 [0.99, 1.10] |
| | Social network closeness | | | | | | |
| | High (≥ 3.2) | 1,356 | 364 (26.84) | 1.00 | 1.00 | 1.00 | 1.00 |
| Low (< 3.2) | 1,434 | 413 (28.80) | 1.09 [0.92, 1.29] | 1.08 [0.91, 1.27] | 1.06 [0.89, 1.26] | 1.05 [0.88, 1.24] | |
| per 1-unit decrease | | | 1.00 [0.88, 1.15] | 0.99 [0.87, 1.14] | 0.98 [0.85, 1.12] | 0.97 [0.84, 1.11] | |
| Women (n=5,244) | Size of social network | | | | | | |
| | Large (≥ 4) | 2,695 | 451 (16.73) | 1.00 | 1.00 | 1.00 | 1.00 |
| | Small (≤ 3) | 3,769 | 1,059 (28.10) | 1.34 [1.16, 1.56] | 1.31 [1.13, 1.52] | 1.28 [1.11, 1.49] | 1.26 [1.08, 1.46] |
| | per 1-unit decrease | | | 1.11 [1.06, 1.16] | 1.10 [1.05, 1.15] | 1.09 [1.04, 1.14] | 1.08 [1.03, 1.13] |
| | Social network closeness | | | | | | |
| | High (≥ 3.2) | 3,226 | 759 (23.53) | 1.00 | 1.00 | 1.00 | 1.00 |
| Low (< 3.2) | 3,238 | 751 (23.19) | 0.93 [0.81, 1.08] | 0.90 [0.77, 1.04] | 0.90 [0.77, 1.04] | 0.89 [0.77, 1.04] | |
| per 1-unit decrease | | | 0.97 [0.87, 1.09] | 0.95 [0.84, 1.06] | 0.94 [0.84, 1.06] | 0.89 [0.71, 1.11] | |
| Hospital-based high-risk participants (N=1,683) | | | | | | | |
| Gender | Social network properties | No. of people | No. (%) metabolic syndrome | Model 1 ^a | Model 2 ^b | Model 3 ^c | Model 4 ^d |
| | | | | OR [95% CI] | OR [95% CI] | OR [95% CI] | OR [95% CI] |
| Men (N=972) | Size of social network | | | | | | |
| | Large (≥ 4) | 143 | 48 (33.57) | 1.00 | 1.00 | 1.00 | 1.00 |
| | Small (≤ 3) | 568 | 257 (45.25) | 0.93 [0.65, 1.31] | 0.94 [0.66, 1.34] | 0.94 [0.66, 1.34] | 0.95 [0.66, 1.37] |
| | per 1-unit decrease | | | 0.94 [0.86, 1.03] | 0.94 [0.86, 1.04] | 0.94 [0.86, 1.04] | 0.94 [0.86, 1.04] |
| | Social network closeness | | | | | | |
| | High (≥ 3.2) | 918 | 360 (39.22) | 1.00 | 1.00 | 1.00 | 1.00 |
| Low (< 3.2) | 571 | 225 (39.40) | 0.95 [0.73, 1.24] | 0.96 [0.73, 1.27] | 0.93 [0.70, 1.23] | 0.91 [0.64, 1.65] | |
| per 1-unit decrease | | | 1.03 [0.84, 1.26] | 1.05 [0.85, 1.29] | 1.02 [0.83, 1.26] | 1.00 [0.81, 1.23] | |
| Women | Size of social network | | | | | | |

| | | | | | | | |
|---------|--------------------------|-------|-------------|--------------------------|--------------------------|--------------------------|--------------------------|
| (N=711) | Large (≥ 4) | 205 | 78 (38.05) | 1.00 | 1.00 | 1.00 | 1.00 |
| | Small (≤ 3) | 1,015 | 509 (50.15) | 1.60 [1.08, 2.35] | 1.52 [1.03, 2.25] | 1.55 [1.05, 2.30] | 1.53 [1.03, 2.27] |
| | per 1-unit decrease | | | 1.12 [1.01, 1.25] | 1.10 [0.98, 1.23] | 1.10 [0.98, 1.23] | 1.10 [0.98, 1.23] |
| | Social network closeness | | | | | | |
| | High (≥ 3.2) | 763 | 339 (44.43) | 1.00 | 1.00 | 1.00 | 1.00 |
| | Low (< 3.2) | 457 | 248 (54.27) | 1.16 [0.85, 1.59] | 1.20 [0.87, 1.66] | 1.15 [0.83, 1.60] | 1.12 [0.80, 1.56] |
| | per 1-unit decrease | | | 1.13 [0.90, 1.42] | 1.17 [0.92, 1.48] | 1.13 [0.89, 1.44] | 1.12 [0.88, 1.43] |

^aAdjusted for age.

^bAdjusted for age, household income and education.

^cAdjusted for age, household income, education, and comorbidities.

^dAdjusted for age, household income, education, comorbidities, drinking status, smoking status, and physical activity.

Supplemental Material 6. Gender-specific association between social network properties and metabolic syndrome components (N=10,103)

| <Community-based population (N=8,097)> | | | | | | | | | | | | |
|--|---------------------------|-------|-----------------------------|-----------------------------|----------------------|----------------------|----------------------|-----------------------------|----------------------|----------------------|----------------------|-----------------------------|
| Sex | Social network properties | No. | Central obesity | | Low HDL cholesterol | | High triglyceride | | High blood pressure | | High fasting glucose | |
| | | | No. | OR [95% CI] | No. | OR [95% CI] | No. | OR [95% CI] | No. | OR [95% CI] | No. | OR [95% CI] |
| Men (n=2,808) | Network size | | | | | | | | | | | |
| | Large (≥4) | 1,134 | 395 | ref | 187 | ref | 478 | ref | 449 | ref | 350 | ref |
| | Small (≤3) | 1,674 | 666 | 1.19 [1.01, 1.39] | 333 | 1.22 [0.99, 1.50] | 670 | 0.92 [0.78, 1.07] | 691 | 1.04 [0.89, 1.23] | 682 | 1.34 [1.13, 1.58] |
| | 1-unit change | | | 1.06 [1.01, 1.11] | | 1.04 [0.99, 1.10] | | 0.97 [0.93, 1.02] | | 0.98 [0.94, 1.03] | | 1.10 [1.05, 1.15] |
| | Closeness | | | | | | | | | | | |
| | High (≥3.2) | 1,373 | 491 | ref | 253 | ref | 560 | ref | 556 | ref | 476 | ref |
| Low (<3.2) | 1,435 | 570 | 1.15 [0.99, 1.35] | 267 | 0.98 [0.81, 1.20] | 598 | 1.01 [0.86, 1.18] | 584 | 0.97 [0.83, 1.14] | 556 | 1.04 [0.88, 1.22] | |
| 1-unit change | | | 1.06 [0.93, 1.20] | | 0.92 [0.79, 1.08] | | 0.90 [0.79, 1.02] | | 0.94 [0.82, 1.07] | | 1.02 [0.90, 1.17] | |
| Women (n=5,289) | Network size | | | | | | | | | | | |
| | Large (≥4) | 2,491 | 1,004 | ref | 631 | ref | 468 | ref | 491 | ref | 444 | ref |
| | Small (≤3) | 2,798 | 1,384 | 1.29 [1.15, 1.45] | 768 | 1.04 [0.92, 1.18] | 626 | 1.13 [0.98, 1.30] | 619 | 1.05 [0.91, 1.21] | 644 | 1.23 [1.07, 1.42] |
| | 1-unit change | | | 1.10 [1.06, 1.14] | | 1.02 [0.98, 1.06] | | 1.04 [1.00, 1.09] | | 1.01 [0.97, 1.06] | | 1.09 [1.04, 1.14] |
| | Closeness | | | | | | | | | | | |
| | High (≥3.2) | 2,504 | 1,047 | ref | 632 | ref | 500 | ref | 490 | ref | 499 | ref |
| Low (<3.2) | 2,785 | 1,341 | 1.09 [0.97, 1.23] | 767 | 1.07 [0.93, 1.21] | 594 | 0.94 [0.81, 1.08] | 620 | 1.01 [0.88, 1.16] | 589 | 0.93 [0.80, 1.07] | |
| 1-unit change | | | 1.11 [1.01, 1.22] | | 1.07 [0.97, 1.19] | | 0.98 [0.87, 1.10] | | 0.97 [0.87, 1.09] | | 0.89 [0.80, 1.00] | |

^aAdjusted for age, household income, education level, comorbidities, social network closeness, alcohol consumption, and cigarette smoking.
OR, odds ratio; 95% CI, 95% confidence interval.

| <Hospital-based population (N=2,006)> | | | | | | | | | | | | |
|--|---------------------------|-----|----------------------|----------------------|----------------------|----------------------|------------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Sex | Social network properties | No. | Central obesity | | Low HDL cholesterol | | High triglyceride | | High blood pressure | | High fasting glucose | |
| | | | No. | OR [95% CI] | No. | OR [95% CI] | No. | OR [95% CI] | No. | OR [95% CI] | No. | OR [95% CI] |
| Men (n=1,168) | Network size | | | | | | | | | | | |
| | Large (≥ 4) | 183 | 85 | ref | 52 | ref | 63 | ref | 79 | ref | 121 | ref |
| | Small (≤ 3) | 985 | 464 | 0.99 [0.91, 1.07] | 301 | 0.98 [0.69, 1.41] | 294 | 0.98 [0.96, 1.00] | 462 | 1.10 [0.80, 1.52] | 680 | 1.15 [0.81, 1.63] |
| | 1-unit change | | | 0.99 [0.91, 1.07] | | 0.96 [0.87, 1.05] | | 0.94 [0.86, 1.03] | | 1.01 [0.93, 1.10] | | 0.96 [0.87, 1.05] |
| | Closeness | | | | | | | | | | | |
| | High (≥ 3.2) | 725 | 344 | ref | 225 | ref | 212 | ref | 325 | ref | 493 | ref |
| | Low (< 3.2) | 443 | 205 | 1.01 [0.84, 1.21] | 128 | 0.80 [0.61, 1.05] | 145 | 1.24 [0.95, 1.62] | 216 | 1.12 [0.88, 1.43] | 308 | 0.96 [0.74, 1.26] |
| 1-unit change | | | 1.01 [0.84, 1.21] | | 0.83 [0.67, 1.02] | | 1.14 [0.94, 1.39] | | 1.07 [0.89, 1.28] | | 1.01 [0.82, 1.23] | |
| Women (n=838) | Network size | | | | | | | | | | | |
| | Large (≥ 4) | 167 | 93 | ref | 67 | ref | 37 | ref | 61 | ref | 88 | ref |
| | Small (≤ 3) | 671 | 418 | 1.27 [0.89, 1.81] | 307 | 1.26 [0.88, 1.80] | 183 | 1.31 [0.87, 1.97] | 251 | 1.01 [0.70, 1.46] | 398 | 1.29 [0.91, 1.84] |
| | 1-unit change | | | 1.07 [0.96, 1.19] | | 1.02 [0.92, 1.13] | | 1.05 [0.94, 1.18] | | 1.02 [0.92, 1.14] | | 1.07 [0.97, 1.19] |
| | Closeness | | | | | | | | | | | |
| | High (≥ 3.2) | 542 | 314 | ref | 234 | ref | 127 | ref | 210 | ref | 305 | ref |
| | Low (< 3.2) | 296 | 197 | 1.26 [0.92, 1.72] | 140 | 1.10 [0.81, 1.49] | 93 | 1.37 [0.98, 1.92] | 102 | 0.70 [0.51, 0.96] | 181 | 0.99 [0.73, 1.35] |
| 1-unit change | | | 1.17 [0.93, 1.48] | | 1.04 [0.83, 1.30] | | 1.37 [1.08, 1.73] | | 0.73 [0.58, 0.91] | | 1.08 [0.86, 1.36] | |

Supplemental Material 7. Direct and indirect effects of social network properties on metabolic syndrome in the original dataset (N=9,717)^a

| Community-based low-risk participants (N=8,034) | | | | | | |
|---|----------------------|--|----------------|------------------------|--|----------------|
| Social network properties | Men (N=2,790) | | | Women (N=5,244) | | |
| | Effect size | [95% CI]^b (×10⁻²) | p-value | Effect size | [95% CI]^b (×10⁻²) | p-value |
| Size of social network | | | | | | |
| Direct effect | 3.11 | [-0.32, 6.48] | 0.075 | 3.16 | [1.12, 5.17] | 0.002 |
| Indirect effect – physical activity | 0.61 | [0.14, 1.14] | 0.012 | 0.32 | [0.11, 0.56] | 0.001 |
| Indirect effect – cigarette smoking | 0.00 | [-0.09, 0.09] | 0.984 | 0.00 | [-0.05, 0.04] | 0.902 |
| Indirect effect – alcohol consumption | 0.00 | [-0.09, 0.10] | 0.952 | -0.02 | [-0.11, 0.03] | 0.436 |
| Indirect effect – depressive symptoms | 0.89 | [-2.00, 4.55] | 0.761 | 0.02 | [-0.13, 0.17] | 0.825 |
| Social network closeness | | | | | | |
| Direct effect | 0.89 | [-2.45, 4.26] | 0.602 | -1.58 | [-3.66, 0.47] | 0.138 |
| Indirect effect – physical activity | 0.09 | [-0.09, 0.33] | 0.340 | 0.04 | [-0.06, 0.16] | 0.450 |
| Indirect effect – cigarette smoking | 0.02 | [-0.13, 0.20] | 0.781 | 0.02 | [-0.04, 0.09] | 0.522 |
| Indirect effect – alcohol consumption | 0.13 | [-0.25, 0.54] | 0.457 | 0.03 | [-0.03, 0.12] | 0.373 |
| Indirect effect – depressive symptoms | 0.14 | [-0.19, 0.48] | 0.384 | 0.02 | [-0.19, 0.23] | 0.823 |
| Hospital-based high-risk population, age range restricted to 30-64 years (N=1,683) | | | | | | |
| Social network properties | Men (N=972) | | | Women (N=711) | | |
| | Effect size | [95% CI]^b (×10⁻²) | p-value | Effect size | [95% CI]^b (×10⁻²) | p-value |
| Size of social network | | | | | | |
| Direct effect | -1.15 | [-9.42, 6.74] | 0.788 | 9.59 | [0.66, 18.19] | 0.035 |
| Indirect effect – physical activity | 0.15 | [-0.44, 0.88] | 0.588 | 0.31 | [-0.42, 1.06] | 0.532 |
| Indirect effect – cigarette smoking | -0.38 | [-1.63, 0.72] | 0.491 | 0.22 | [-0.49, 1.11] | 0.495 |
| Indirect effect – alcohol consumption | -0.25 | [-1.04, 0.23] | 0.370 | -0.09 | [-0.82, 0.43] | 0.774 |
| Indirect effect – depressive symptoms | 0.32 | [-0.37, 1.17] | 0.349 | -0.04 | [-0.59, 0.45] | 0.892 |
| Social network closeness | | | | | | |
| Direct effect | -2.16 | [-8.47, 4.19] | 0.514 | 2.76 | [-4.84, 10.65] | 0.500 |
| Indirect effect – physical activity | 0.02 | [-0.22, 0.31] | 0.899 | 0.02 | [-0.34, 0.45] | 0.935 |
| Indirect effect – cigarette smoking | 0.50 | [-0.38, 1.55] | 0.274 | 0.46 | [-0.35, 1.79] | 0.311 |
| Indirect effect – alcohol consumption | 0.03 | [-0.34, 0.46] | 0.878 | 0.21 | [-0.76, 1.30] | 0.660 |
| Indirect effect – depressive symptoms | 0.85 | [0.11, 1.78] | 0.015 | 0.59 | [-0.64, 1.92] | 0.316 |

^aEstimated using the 'mediation' package. Quasi-Bayesian Monte Carlo method was conducted with 5,000 times of simulation each.

^bAdjusted for age, household income, education level, comorbidities, and social network closeness.

95% CI, 95% confidence interval

Supplemental Material 8. Direct effects of social network size and indirect effects via physical activity on metabolic syndrome and its components^a.

| | | Community-based low-risk participants (N=8,097) | | | | | |
|--------------------|---------------------------|---|--------------------------|--------------------------|--------------------------|-----------------------|--------------------------|
| Gender | Social network properties | Effect size [95% CI] ($\times 10^{-2}$) | | | | | |
| | | Metabolic syndrome | Central obesity | Low HDL cholesterol | High triglyceride | High blood pressure | High fasting glucose |
| Men (n=2,808) | Network size | | | | | | |
| | Direct effect | 3.65 [1.74, 7.07] | 3.90 [0.19, 7.66] | 2.90 [-0.11, 5.84] | -2.03 [-5.68, 1.70] | 1.04 [-2.68, 4.72] | 6.31 [2.74, 9.98] |
| | Indirect effect | 0.52 [0.08, 1.05] | 0.71 [0.23, 1.29] | 0.37 [-0.02, 0.81] | 0.76 [0.27, 1.31] | -0.10 [-0.59, 0.38] | 0.51 [0.04, 1.04] |
| | Closeness | | | | | | |
| | Direct effect | 1.45 [-1.99, 4.84] | 3.31 [-0.42, 7.00] | -0.21 [-3.10, 2.68] | 0.17 [-3.38, 3.72] | -0.68 [-4.34, 2.93] | 0.85 [-2.74, 4.47] |
| | Indirect effect | 0.07 [-0.08, 0.29] | 0.08 [-0.13, 0.35] | 0.04 [-0.07, 0.20] | 0.09 [-0.13, 0.36] | -0.01 [-0.13, 0.08] | 0.06 [-0.10, 0.27] |
| Women (n=5,289) | Network size | | | | | | |
| | Direct effect | 3.19 [1.15, 5.20] | 5.97 [3.29, 8.64] | 0.77 [-1.55, 3.13] | 1.92 [-0.25, 4.15] | 0.70 [-1.51, 2.90] | 3.17 [1.03, 5.33] |
| | Indirect effect | 0.31 [0.11, 0.55] | 0.49 [0.23, 0.78] | 0.39 [0.15, 0.68] | 0.32 [0.10, 0.57] | 0.11 [-0.08, 0.32] | 0.22 [0.02, 0.45] |
| | Closeness | | | | | | |
| | Direct effect | -1.40 [-3.43, 0.56] | 2.02 [-0.66, 4.63] | 1.20 [-1.29, 3.63] | -1.07 [-3.28, 1.17] | 0.10 [-2.10, 2.25] | -1.17 [-3.37, 1.02] |
| | Indirect effect | 0.05 [-0.05, 0.17] | 0.08 [-0.08, 0.26] | 0.06 [-0.06, 0.22] | 0.05 [-0.05, 0.17] | 0.02 [-0.03, 0.09] | 0.04 [-0.04, 0.14] |
| | | Hospital-based high-risk participants (N=2,006) | | | | | |
| Gender | Social network properties | Effect size [95% CI] ($\times 10^{-2}$) | | | | | |
| | | Metabolic syndrome | Central obesity | Low HDL cholesterol | High triglyceride | High blood pressure | High fasting glucose |
| Men (n=1,168) | Network size | | | | | | |
| | Direct effect | -1.12 [-9.07, 6.51] | 1.39 [-6.58, 9.11] | -0.42 [-7.88, 6.71] | -2.69 [-10.19, 4.36] | 2.33 [-5.60, 10.62] | 2.82 [-4.13, 10.31] |
| | Indirect effect | 0.13 [-0.47, 0.80] | 0.64 [0.00, 1.60] | 0.40 [-0.17, 1.21] | 0.17 [-0.42, 0.88] | -0.20 [-0.94, 4.01] | 0.07 [-0.52, 0.73] |
| | Closeness | | | | | | |
| | Direct effect | -1.44 [-7.34, 4.19] | 0.31 [-5.83, 6.27] | -4.47 [-9.77, 1.07] | 4.44 [-1.15, 9.95] | 2.82 [-3.16, 8.76] | -0.78 [-6.25, 4.60] |
| | Indirect effect | 0.04 [-0.18, 0.33] | 0.17 [-0.21, 0.66] | 0.10 [-0.16, 0.50] | 0.05 [-0.17, 0.35] | -0.05 [-0.36, 0.16] | 0.02 [-0.20, 0.28] |
| Women (n=838) | Network size | | | | | | |
| | Direct effect | 8.40 [0.09, 16.23] | 5.41 [-2.59, 13.70] | 5.29 [-2.95, 13.23] | 4.76 [-2.58, 11.60] | 0.19 [-7.89, 7.84] | 5.87 [-2.49, 14.45] |
| | Indirect effect | 0.07 [-0.61, 0.82] | -0.14 [-0.87, 0.52] | -0.65 [-1.72, 0.02] | -0.05 [-0.68, 0.53] | 0.04 [-0.64, 0.74] | 0.17 [-0.47, 0.95] |
| | Closeness | | | | | | |
| | Direct effect | 1.33 [-5.69, 8.18] | 5.14 [-1.65, 3.12] | 2.32 [-4.89, 9.56] | 6.05 [-0.11, 12.78] | -7.73 [-14.33, -0.88] | -0.11 [-7.13, 6.79] |
| | Indirect effect | 0.04 [-0.33, 0.47] | -0.07 [-0.55, 0.31] | -0.33 [-1.13, 0.22] | -0.03 [-0.45, 0.33] | 0.02 [-0.38, 0.43] | 0.08 [-0.26, 0.59] |

^aEstimated using the 'mediation' package. Quasi-Bayesian Monte Carlo method was conducted with 5,000 times of simulation each.

^bAdjusted for age, household income, education level, comorbidities, social network closeness, alcohol consumption, and cigarette smoking. 95% CI, 95% confidence interval.