Supplementary appendix 3

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Alcohol consumption and oesophageal squamous cell cancer risk in Africa: findings from the large multi-centre ESCCAPE case-control study in Kenya, Tanzania, and Malawi

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Estimated ethanol content of alcoholic beverages

Note to reader: The information provided describes literature estimates of the alcohol content of different beverages. This study did not make objective measurements of the alcoholic drinks consumed by study participants, but employed best estimates based on limited available data. When quoting these methods/estimates, please be sure to read and cite the original source articles and consider their scope and limitations.

Overview: For the purpose of estimating ethanol (EtOH) content, alcoholic beverages in all three countries fall into three broad categories: commercial drinks; home-brewed weaker/fermented drinks and home-brewed strong/distilled drinks. Commercial drinks include beer, wine, cider, spirits such as gin and whisky, and, in Malawi, a commercially brewed opaque beer – chibuku – based on traditional cereal-based brews. Ethanol estimates for most commercial drinks were available directly from manufacturers. Home-brewed weaker/fermented drinks are common across the three countries, with each country having its own dominant variety, e.g. busaa (Kenya), mbege (Tanzania) and masese (Malawi). Further varieties exist within countries depending on specific brewing practices as well as local dialects. Where possible, literature references containing ethanol content measurements for specific drinks were used. In the absence of estimates for less common drinks, particularly in Malawi, drinks were grouped and estimates of the most closely related beverages were used with the help of local knowledge from the study team. This category also contains slightly stronger...
home-brewed ‘wines’ such as banana wine, honey wine (*muratina*) and coconut wine (*mnazi*). Home-brewed
strong/distilled drinks include *changaa/gongo* in Kenya and Tanzania, and *kachasu* in Malawi. These clear
moonshines range between 20–50\% ethanol content. In Kenya, participants were additionally asked whether
they drank the weaker (~23\%) or stronger (>50\%) variety of *changaa*. For both weaker and strong home-brewed
beverages, ethanol estimates from the study countries were prioritised when available, but given the lack of
literature on the subject, estimates of the same or closely related drinks from neighbouring countries were
sometimes used. The EtOH content estimates of different drinks applied to study calculations are listed in Table
S1, with additional descriptions and justifications presented after.

**Table S1** The estimated ethanol (EtOH) content of different alcoholic drinks reported by study participants used
in EtOH intake calculations.

| Drink                  | Country          | Strength group\( ^a \) | Estimated EtOH, \% | Literature reference, where applicable |
|------------------------|------------------|------------------------|--------------------|------------------------------------------|
| **Traditional beer**   |                  |                        |                    |                                          |
| Busaa                  | Kenya            | ‘Low ABV’              | 4                  | [1]                                      |
| Mbege                  | Tanzania         | ‘Low ABV’              | 2.2                | [2]                                      |
| Komoni                 | Tanzania         | ‘Low ABV’              | 5.4                | [2]                                      |
| Busaa                  | Tanzania         | ‘Low ABV’              | 4                  | [1]                                      |
| Dadii                  | Tanzania         | ‘Low ABV’              | 4.25               | [3]                                      |
| Kangara                | Tanzania         | ‘Low ABV’              | 6.1                | [2]                                      |
| Kindi                  | Tanzania         | ‘Low ABV’              | 4.2                | [2]                                      |
| Other ‘opaque brews’   | Tanzania         | ‘Low ABV’              | 5                  |                                          |
| Chibuku\(^b \)         | Malawi           | ‘Low ABV’              | 4                  | [4]                                      |
| Other ‘opaque brews’   | Malawi           | ‘Low ABV’              | 4                  |                                          |
| **Commercial drinks**  |                  |                        |                    |                                          |
| Commercial beer        | Multiple countries| ‘Low ABV’              | 4.7                |                                          |
| Commercial spirits     | Multiple countries| ‘High ABV’             | 37.5               |                                          |
| Commercial cider       | Multiple countries| ‘Low ABV’              | 6                  |                                          |
| Amarula                | Multiple countries| ‘Low ABV’              | 17                 |                                          |
| Commercial wine        | Multiple countries| ‘Low ABV’              | 13.5               |                                          |
| **Traditional distillations** |            |                        |                    |                                          |
| Changaa/gongo          | Kenya, Tanzania  | ‘High ABV’             | 38                 | [2]                                      |
| Kachasu, jangala and  | Malawi           | ‘High ABV’             | 34                 | [5]                                      |
| chikokeyani            |                  |                        |                    |                                          |
| **Other traditionally produced drinks** |            |                        |                    |                                          |
| Dengelua               | Tanzania         | ‘Low ABV’              | 5.8                | [6]                                      |
| Ulanzi                 | Tanzania         | ‘Low ABV’              | 5.5                | [7]                                      |
| Banana wine            | Tanzania         | ‘Low ABV’              | 2.75               | [7]                                      |
| Mnazi                  | Tanzania         | ‘Low ABV’              | 6.95               | [7]                                      |
| Muratina               | Tanzania         | ‘Low ABV’              | 4.5                | [8]                                      |
| Wanzuki                | Tanzania         | ‘Low ABV’              | 7.9                | [7]                                      |

\(^a\) The grouping used to categorize study participants as drinkers of ‘low ABV’ (\(\leq 30\%\)) and ‘high ABV’ (>30\%)
beverages. \(^b\) Chibuku is produced commercially, but is grouped with traditional beers due to its composition and
alcohol content.

**Additional notes on drink types**

**Multiple countries:**

2
**Commercial beer:** A wide variety of commercial beers is available in each country, ranging between ~4 and 5.5% ethanol according to online information available directly from manufacturers. The questionnaire did not ask for specific brands and, for consistency, a single estimate was used – 4.7%.

**Commercial spirits:** These include gin, rum, whisky, brandy, vodka, sherry, konyagi, cane spirit, viroba, powers, kadamsana. Participants were asked about their consumption of spirits in bottles and sachets separately. A single estimate was used for all commercial spirits – 37.5%.

**Commercial cider:** Only reported through the ‘other drinks’ question with the type unspecified. The ethanol content of the popular South African cider ‘Savanna Dry’, available in all three countries, was used – 6%.

**Amarula:** Only reported through the ‘other drinks’ question. Amarula is a South African cream liqueur with an ethanol content of 17%.

**Commercial wine:** Only reported through the ‘other drinks’ question with the type often unspecified. A single estimate was used – 13.5%.

**Kenya:**

**Busaa:** A home-brewed opaque beer from sorghum, maize and millet commonly consumed in Kenya and similar to Tanzanian mbege. The mean ethanol content of 10 samples measured in Eldoret, Kenya [1] was used – 4%.

**Tanzania:**

**Mbege:** A popular home-brewed opaque beer made from banana and sorghum. An ethanol content estimate [2] was available for mbege in Northern Tanzania (3 samples) – 2.2%.

**Changaa/gongo:** A strong moonshine distilled from cassava and maize in Kenya and Tanzania. Ethanol contents were available [2] for two varieties brewed in Northern Tanzania: weaker (23%, 7 samples) and stronger (53%, 5 samples). Participants were not ask which variety they consumed in Tanzania and the mean of these two values was used – 38%.

**Dengelua:** A traditional fermentation made from honey and sugarcane. An ethanol content was available from a measurement made on a sample collected in Dar es Salaam [6] – 5.8%.

**Ulanzi:** A type of fermented beverage made from bamboo. An ethanol content was available from measurements made on at least 5 samples of ‘bamboo wine’ collected Dar es Salaam [7] – 5.5%.

**Komoni:** A home-brewed opaque beer brewed with corn husks, maize and sorghum. Its ethanol content was available from 9 samples collected in Northern Tanzania [2] – 5.4%.

**Banana wine:** An ethanol content was available from measurements made on at least 5 samples of banana wine collected Dar es Salaam [7] – 2.75%.

**Busaa:** A home-brewed opaque beer from sorghum, maize and millet commonly consumed in Kenya and similar to mbege. The mean ethanol content of 10 samples measured in Eldoret, Kenya [1] was used – 4%.

**Dadii:** A home-brewed opaque beer brewed with maize and finger millet. Its ethanol content was available from 5 market-ready samples collected in Dar es Salaam [3] – 4.25%.

**Kangara:** A home-brewed opaque beer, brewed with maize and sorghum. Its ethanol content was available from 3 samples collected in Northern Tanzania [2] – 6.1%.

**Kindi:** A home-brewed opaque beer, brewed with maize and sorghum. Its ethanol content was available from 3 samples collected in Northern Tanzania [2] – 4.2%.

**Mnazi:** An ethanol content was estimated from measurements made on at least 5 samples of ‘coconut palm wine’ collected Dar es Salaam ranging from 6.1-7.8% [7] – 6.95%.

**Murutina:** An East African mead. Reported to range between 3-6% ethanol in Kenya [8]. In the absence of Tanzanian estimates, the mean of this reported range was used - 4.5%.

**Wanzuki:** Possibly similar to muritana and made from honey, sugar and yeast. An ethanol content was estimated from measurements made on at least 5 samples of wanzuki collected Dar es Salaam ranging from 7.5-8.3% [7] – 7.9%.
Other opaque brews: Responses for kimea and manguree (‘malt’ in Swahili) were also received. No specific references or ethanol content estimates could be located, and the mean of estimates for similar local cereal-based brews (komoni, dadii, kangara and kindi) was used – 5%.

Malawi:

Chibuku: A commercially brewed maize and sorghum-based opaque beer sold in cartons and plastic bottles and based on the traditionally brewed beverages such as masese. Its alcohol content reportedly ranges between 3-5% [4] but depends on storage durations, with fermentation continuing in the packaging. An estimate based on the mean of this range was used – 4%.

Kachasu, jangala and chikokeyani: Strong moonshines from maize and millet comparable to the changaa and gongo of Kenya and Tanzania. An estimate was made based on ethanol volumes measured in 20 samples of kachasu collected from different townships in the vicinity of Blantyre, Malawi [5]. Values were not published and had to be read from a bar graph using a ruler. The mean of these values was then taken – 34%.

Other opaque brews: Responses for masese, mtonjani, chipiloni, kabanga, chipumu, delunde, mkhotha, uchema, senga and ‘locally brewed beer’ were all grouped as ‘opaque brews’. All are examples of cereal-based traditional home brews on which the commercially brewed chibuku is based, comparable to the busaa and mbege of Kenya and Tanzania, respectively. They are of varying strength depending on brewing technique and storage conditions, ranging between ~2.5-10% ethanol. For consistency, the estimate for chibuku was used – 4%.
|                                    | Kenya |          | Tanzania |          | Malawi |          |
|------------------------------------|-------|----------|----------|----------|--------|----------|
|                                    | Men N=148 | Women N=43 | Men N=114 | Women N=28 | Men N=217 | Women N=35 |
| Ever drank, n (column %)           | Traditional beer | 104 (70) | 31 (72) | 100 (88) | 23 (82) | 201 (93) | 29 (83) |
|                                    | Commercial beer    | 94 (64) | 12 (28) | 99 (87) | 23 (82) | 103 (47) | 6 (17) |
|                                    | Changaa/gongo/kachasu | 97 (66) | 27 (63) | 24 (21) | 0 (0) | 136 (63) | 15 (43) |
|                                    | Commercial spirits    | 53 (36) | 5 (12) | 28 (25) | 0 (0) | 59 (27) | 1 (3) |
|                                    | Banana wine       | NA | NA | 23 (20) | 1 (4) | NA | NA |
|                                    | Other excluded     | 8 (5) | 1 (2) | 12 (11) | 1 (4) | 22 (10) | 2 (6) |
| Estimated drinks per week, if a drinker of this type of alcohol, median (IQR) | Traditional beer | 12 (4-18.3) | 9 (4-17) | 11 (6-19) | 6 (4-8) | 14 (8-24) | 4 (0-6) |
|                                    | Commercial beer    | 8 (5-20) | 8 (4-23) | 10 (8-16) | 8 (4-10) | 6 (2-12) | 4 (3.5-5.5) |
|                                    | Changaa/gongo/kachasu | 9 (5-19) | 8 (6-12) | 13 (13-20) | NA | 15 (3.3-46) | 3.3 (1.2-4.9) |
|                                    | Commercial spirits | 8 (4-14) | 9 (4-9) | 32 (17-69) | NA | 25 (10-50) | NA |
|                                    | Banana wine       | NA | NA | 6 (4.2-7.2) | NA | NA | NA |
| All types (crude sum per person)   | 23.5 (10-48.5) | 12 (6.5-31.5) | 28 (14-56) | 11 (8-16) | 34 (12-95) | 4 (0.7-11) |
| Ethanol intake (g/week), if a drinker of this type of alcohol, median (IQR) | Traditional beer | 213 (71-324) | 159 (71-302) | 104 (64-174) | 52 (35-73) | 179 (69-335) | 63 (32-95) |
|                                    | Commercial beer    | 158 (99-395) | 158 (79-454) | 186 (149-197) | 149 (74-186) | 111 (37-223) | 74 (69-102) |
|                                    | Changaa/gongo/kachasu | 85 (47-171) | 76 (57-114) | 120 (120-180) | NA | 121 (27-376) | 27 (10-40) |
|                                    | Commercial spirits | 66 (33-116) | 75 (33-75) | 289 (148-609) | NA | 222 (89-444) | NA |
|                                    | Banana wine       | NA | NA | 33 (23-39) | NA | NA | NA |
| All types (sum)                    | 348 (135-672) | 213 (82-451) | 364 (219-746) | 182 (91-219) | 477 (194-1051) | 63 (32-163) |
| All types (duration weighted mean) | 284 (124-645) | 163 (81-428) | 256 (164-499) | 133 (77-193) | 324 (126-792) | 47 (32-87) |
| In drinkers, median (IQR) percentage of total ethanol intake contributed by: | Traditional beer | 33% (0-64) | 65% (0-88) | 25% (15-47) | 35% (23-58) | 64% (29-93) | 98% (28-100) |
|                                    | Commercial beer    | 34% (0-59) | 0% (0-25) | 53% (19-81) | 65% (38-77) | 0% (0-19) | 0% (0-0) |
|                                    | Changaa/gongo/kachasu | 14% (0-30) | 15% (0-35) | 0% (0-0) | 0% (0-0) | 2% (0-21) | 0% (0-6) |
|                                    | Commercial spirits | 0% (0-9) | 0% (0-0) | 0% (0-0) | 0% (0-0) | 0% (0-0) | 0% (0-0) |
|                                    | Banana wine       | NA | NA | 0% (0-0) | 0% (0-0) | NA | NA |
| Age first drank, median (IQR)      | Traditional beer | 21 (20-28) | 26 (20-31) | 15 (15-20) | 18 (12-17) | 21 (18-28) | 25 (21-40) |
|                                    | Commercial beer    | 24 (20-29) | 24 (20-27) | 25 (20-30) | 30 (24-35) | 25 (20-32) | 29 (24-37) |
|                                    | Changaa/gongo/kachasu | 22 (20-30) | 30 (20-36) | 30 (24-33) | NA | 25 (20-34) | 39 (26-45) |
|                                    | Commercial spirits | 24 (20-30) | 20 (30-49) | 35 (28-43) | NA | 25 (20-35) | NA |
|                                    | Banana wine       | NA | NA | 45 (35-53) | NA | NA | NA |
| Any alcohol                        | 22 (20-28) | 26 (20-31) | 15 (15-20) | 19 (13-25) | 21 (18-25) | 25 (25-27) |

*Includes *busaa* in Kenya, *mbenge* and *komoni* plus *busaa*, *kimea*, *kindi*, *daditi*, *kangara* and *manguree* (reported in other drinks) in Tanzania and *chibuku* plus *masele* (reported in other drinks) in Malawi. Excluding those counted towards traditional beer. Medians are only reported if data from at least 5 people were available.
Table S3 Minimally adjusted odds ratios (OR1) and 95% confidence intervals (CI) for the association of alcohol consumption with oesophageal cancer risk in Kenya, Tanzania and Malawi (sex-specific).

| Exposure                        | Group            | Categories                  | N (%) of cases/controls | OR1 (95% CI) |
|--------------------------------|------------------|-----------------------------|-------------------------|--------------|
|                                |                  | Kenya                       | Tanzania                | Malawi       | Kenya | Tanzania | Malawi       |              |
| Ever alcohol consumption       | Both sexes       | Never                       | 113(26) / 249(57)       | 75(24) / 171(55) | 281(52) / 341(58) | 1    | 1        | 1              | 3.83 (2.81, 5.26) |
|                                |                  | Ever                        | 317(74) / 191(43)       | 235(76) / 142(45) | 258(48) / 252(42) | 1    | 1        | 1              | 4.01 (2.81, 5.76) |
|                                | Men              | Never                       | 40(14) / 124(46)        | 35(15) / 123(52) | 105(34) / 118(35) | 1    | 1        | 1              | 4.86 (3.23, 7.43) |
|                                |                  | Ever                        | 242(86) / 148(54)       | 202(85) / 114(48) | 206(66) / 217(65) | 1    | 1        | 1              | 6.31 (4.08, 9.96) |
|                                | Women            | Never                       | 73(49) / 125(74)        | 40(55) / 48(63)  | 176(77) / 223(86)| 1    | 1        | 1              | 2.90 (1.76, 4.85) |
|                                |                  | Ever                        | 75(51) / 43(26)         | 33(45) / 28(37)  | 52(23) / 35(14)  | 1    | 1        | 1              | 1.43 (0.73, 2.82) |
|                                | Never tobacco    | Users                       | 105(59) / 225(74)       | 49(53) / 161(65) | 232(76) / 305(70)| 1    | 1        | 1              | 1.87 (1.15, 3.07) |
|                                | Ever tobacco     | Users                       | 72(41) / 78(26)         | 43(47) / 86(35)  | 64(22) / 131(30)| 1    | 1        | 1              | 0.68 (0.47, 0.99) |
|                                | Type of drinker  | by strength                |                          |              |                  | 1    | 1        | 1              | 1.27 (0.75, 2.14) |
|                                | All              | Never                      | 113(26) / 249(57)       | 75(24) / 171(55) | 281(52) / 341(58) | 1    | 1        | 1              | 1.73 (1.06, 2.8) |
|                                |                  | Low ABV only                | 40(9) / 52(12)          | 81(26) / 103(33)| 71(13) / 88(15)  | 1    | 1        | 1              | 1.73 (1.16, 2.59) |
|                                |                  | High ABV                    | 277(64) / 139(32)       | 154(50) / 39(12) | 187(35) / 164(28)| 1    | 1        | 1              | 0.99 (0.68, 1.43) |
|                                | Average number   | drinks (n/week)             |                          |              |                  | 1    | 1        | 1              | 1.41 (1.04, 1.90) |
|                                | All              | Never                      | 113(26) / 249(57)       | 75(24) / 171(55) | 281(52) / 341(58) | 1    | 1        | 1              | 1.73 (1.06, 2.8) |
|                                |                  | Low ABV only                | 72(17) / 72(16)         | 32(10) / 40(13)  | 92(17) / 90(15)  | 1    | 1        | 1              | 1.22 (0.86, 1.72) |
|                                |                  | High ABV                    | 74(17) / 40(9)          | 29(9) / 44(14)   | 44(8) / 39(7)    | 1    | 1        | 1              | 1.38 (0.85, 2.26) |
|                                |                  | 14-<28                      | 28(11) / 29(7)          | 22(7) / 20(6)   | 28(5) / 23(4)    | 1    | 1        | 1              | 1.51 (0.83, 2.76) |
|                                |                  | 28-<42                      | 123(29) / 50(11)        | 152(49) / 38(12)| 94(17) / 100(17)| 1    | 1        | 1              | 1.16 (0.80, 1.66) |
|                                | Average ethanol  | intake (g/week)             |                          |              |                  | 1    | 1        | 1              | 1.27 (0.75, 2.14) |
|                                | All              | Never                      | 113(26) / 249(57)       | 75(24) / 171(55) | 281(52) / 341(58) | 1    | 1        | 1              | 1.73 (1.06, 2.8) |
|                                |                  | 140-<350                    | 67(16) / 61(14)         | 39(13) / 35(11) | 82(15) / 91(15)  | 2.53 (1.65, 3.88) | 2.24 (1.3, 3.89) | 1.09 (0.76, 1.54) |
|                                |                  | 350-<700                    | 86(20) / 47(11)         | 46(15) / 61(19) | 72(13) / 52(9)   | 4.29 (2.78, 6.7)  | 1.96 (1.2, 3.18) | 1.72 (1.13, 2.62) |
|                                |                  | 700+                        | 82(19) / 45(10)         | 54(17) / 30(10) | 43(8) / 43(7)    | 4.27 (2.74, 6.73) | 5.28 (3.07, 9.27) | 1.26 (0.78, 2.03) |
|                                |                  | 39(13) / 35(11)            | 60(31) / 16(5)          | 61(11) / 66(11) |                | 5.37 (3.35, 8.73) | 18.5 (10.1, 35.7) | 1.15 (0.75, 1.75) |

*a*OR1 adjusted for age and sex.
Table S4 Odds ratios (OR) and 95% confidence intervals (CI) for the association of alcohol consumption with oesophageal cancer risk in Malawi by sex. Effects of ever drinking, drinking strength (Low ABV and High ABV), number of drinks, duration-weighted weekly ethanol intake and percentage ethanol contribution from different drinks.

| Exposure                     | Type of drinker by strength | N (%) of cases/controls | OR1* (95% CI) | OR2† (95% CI) |
|------------------------------|----------------------------|-------------------------|---------------|--------------|
|                               | Never                      | Malawi (men)            | Malawi (women)|              |
|                               | Low ABV only               | 105(34)/118(35)         | 176(77) / 223(86) | 1            |
|                               | High ABV                   | 50(16)/68(20)           | 20(9) / 20(8)  | 0.82 (0.52, 1.29) |
|                               |                            | 155(50)/149(44)         | 32(14) / 15(6)  | 1.14 (0.80, 1.62) |
| Average number of drinks (n/week) | Never  | 105(34)/118(35)         | 176(77) / 223(86) | 1            |
|                               | <14                        | 56(18)/61(18)           | 36(16) / 29(11) | 0.99 (0.63, 1.56) |
|                               | 14-<28                     | 38(12)/37(11)           | 11(4) / 7(4)   | 1.13 (0.66, 1.92) |
|                               | 28-<42                     | 24(8)/22(7)             | 6(2) / 6(2)    | 1.20 (0.63, 2.28) |
|                               | 42+                        | 88(28)/97(29)           | 10(4) / 7(4)   | 1.00 (0.67, 1.47) |
|                               | ≥14                        | 16(7) / 6(2)            | 1.00 (0.67, 1.47) | 1 |
| Average ethanol intake (g/week) | Never  | 105(34)/118(35)         | 176(77) / 223(86) | 1            |
|                               | <140                       | 50(16)/62(19)           | 32(14) / 29(11) | 0.87 (0.55, 1.38) |
|                               | 140-<350                   | 60(19)/50(15)           | 1.32 (0.83, 2.10) | 1.40 (0.81, 2.44) |
|                               | 350-<700                   | 38(12)/41(12)           | 1.02 (0.61, 1.71) | 4.19 (1.71, 11.8) |
|                               | 700+                       | 58(19)/64(19)           | 0.98 (0.63, 1.54) | 1.02 (0.61, 1.71) |
|                               | 1400                       | 16(7) / 6(2)            | 1.00 (0.67, 1.47) | 1.00 (0.67, 1.47) |

 Effect of percentage ethanol contribution from different drinks

| Drink type                  | Median % contribution in case/control ever drinkers | OR1* (95% CI) (per 10% increase in ethanol from a given drink) | OR2† (95% CI) (per 10% increase in ethanol from a given drink) |
|-----------------------------|---------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|
| Traditional beer            | 63/63                                             | 0.99 (0.93, 1.05)     | 0.99 (0.92, 1.05)    | 0.91 (0.81, 1.02)   |
| Commercial beer             | 0/0                                               | 0.99 (0.91, 1.08)     | 1.07 (0.97, 1.17)    | 1.17 (0.98, 1.45)   |
| Changaa/gongo/kachasu       | 3/2                                               | 1.07 (0.99, 1.16)     | 1.02 (0.94, 1.11)    | 1.03 (0.90, 1.18)   |
| Commercial spirits          | 0/0                                               | 0.91 (0.78, 1.06)     | 0.87 (0.74, 1.03)    | 0.99 (0.63, 1.68)   |

*OR1 adjusted for age and sex, †OR2 adjusted for age, sex, tobacco usage (ever/never), tobacco frequency (smokes/chews per day), ethnicity, education and religion. 'Drinkers who reported consuming commercial or traditional distillations (e.g. changaa, gongo, kachasu) >30% ABV were categorized as ‘high ABV’ drinkers.
Table S5: Sex distribution and mean estimated ethanol intake for different drinks compared between control participant drinkers of ‘High ABV’ (>30%) and only ‘Low ABV’ drinks in Kenya, Tanzania, and Malawi.

| Sex, n (%) | Kenya | Tanzania | Malawi |
|------------|-------|----------|--------|
|            | High ABV drinkers | Low ABV drinkers | High ABV drinkers | Low ABV drinkers | High ABV drinkers | Low ABV drinkers |
| Male       | 111 (80) | 37 (71) | 39 (100) | 75 (73) | 149 (91) | 68 (77) |
| Female     | 28 (20) | 15 (29) | 0 (0)    | 28 (27) | 15 (9) | 20 (23) |

Ethanol intake (g/week) if a drinker of this type of alcohol

|                    | Traditional and commercial beer | Changaa/gongo/kachasu | Commercial spirits | All types (sum) | All types (duration weighted mean) |
|--------------------|---------------------------------|-----------------------|--------------------|-----------------|----------------------------------|
| Kenya              | 382                             | 114                   | 39                 | 541             | 485                             |
| Tanzania           | 223                             | 0                     | 0                  | 227             | 208                             |
| Malawi             | 306                             | 102                   | 296                | 760             | 472                             |

Mean intake if a drinker of these types of alcohol:
Post-hoc investigation of alcohol underreporting in Malawi

Post hoc fieldwork and analysis in Malawi were performed due the following findings. Positive associations were found between ESCC and ever versus never alcohol consumption in every country-sex defined stratum, except for Malawi men in whom alcohol had no effect upon minimal adjustment and a protective effect after adjusting for tobacco. This clear outlier finding, contradictory to the known ESCC carcinogenic effect of alcohol, prompted a post hoc re-contacting of a subset of Malawi participants who had provided consent to re-contacting to investigate whether exposure misclassification might explain the results. The subset was stratified by sex and original alcohol status (ever/never). Upon reaching the participant by telephone (or, for most cases, their next of kin), ever alcohol and tobacco consumption were re-asked. This observed extent of exposure misclassification was used to correct observed ORs using the methods of Lash et al. 2009 [9].

When attempting to recontact 310 participants (177 cases and 133 controls), 53% were reached and agreed to participate. Among contacts, 98% of cases had died so the recontact was with the next of kin, whereas for controls, the recontact was the original participant 88% of the time. Thus 165 participants have repeated alcohol exposure assessments: 52 male cases, 46 female cases, 46 male controls and 21 female controls (Table S6). Assuming that a positive answer to alcohol was never a false-positive, cross-classification of the original and second alcohol status (Table S6) demonstrated that both the original and second alcohol status were subject to misclassification. The greatest misclassification occurred in male cases (62% agreement between assessments, kappa (k) =0.20) which was lower than in male controls (78%, k=0.57). In women, agreement and kappa were generally higher, but revealed the same pattern of greater misclassification in cases versus controls (72% v 86% agreement, k=0.45 and k=60) (Table S6). These agreement levels correspond to an exposure sensitivity of 55% in male cases and 74% in male controls, and approximately 85% in both female cases and controls. Note that the assuming of no false positives is equivalent to a specificity of 100%. Odds ratio corrections were made to achieve as close to these sensitivities as possible, with the constraints of the total number of cases and controls. In men, the correction applied was using sensitivities of 70% in cases and 74% in controls, and in women 85% in both cases and controls. Sex-specific crude ORs for drinking status (ever/never) are in Table S7. For women, the crude OR increased from 1.88 to 1.93 and, for men, from 1.07 to 2.51.

Table S6 Agreement between initial and repeat alcohol exposure assessment.

| Subset ↓ | N | Original response ↓ | Non-drinker | Drinker | % drinkers based on data provided at: | % agreement between first and second | Kappa (95% CI) |
|----------|---|---------------------|------------|--------|------------------------------------|--------------------------------------|----------------|
|          |   | Recontact response with participant / NOK | 1st contact | 2nd contact | Either: Drinker on either occasion |                                     |                |
| Men      |   |                                   |            |         |                                    |                                      |                |
| Cases    | 52 | Non-drinker | 21 | 11 | 42% | 60% | 62 | 0.20 (-0.07, 0.47) |
|          |    | Drinker     |   |     | 38% |     |    |                |
| Controls | 46 | Non-drinker | 19 | 6  | 46% | 59% | 78 | 0.57 (0.28, 0.85) |
|          |    | Drinker     | 4  | 17 |     |     |    |                |
| Women    |   |                                   |            |         |                                    |                                      |                |
| Cases    | 46 | Non-drinker | 17 | 3  | 57% | 63% | 72 | 0.45 (0.17, 0.72) |
|          |    | Drinker     | 10 | 16 |     |     |    |                |
| Controls | 21 | Non-drinker | 12 | 1  | 38% | 43% | 86 | 0.69 (0.26, 1.12) |
|          |    | Drinker     | 2  | 6  |     |     |    |                |
Table S7 Uncorrected and corrected odds ratios for the association of alcohol and ESCC assuming, correcting for under-reporting of alcohol.

| Sex   | No. cases | No. controls | Sensitivity cases | Sensitivity controls | Specificity cases | Specificity controls | Uncorrected OR | Corrected OR* |
|-------|-----------|--------------|-------------------|----------------------|-------------------|---------------------|----------------|---------------|
| Men   | 311       | 335          | 0.70              | 0.74                 | 1                 | 1                   | 1.07           | 2.51          |
| Women | 228       | 258          | 0.85              | 0.85                 | 1                 | 1                   | 1.88           | 1.93          |

* Corrected ORs were estimated using the sensitivity and specificity noted, with crude numbers of exposed/unexposed cases/controls entered into excel tools provided in Chapter 6 on Misclassification, downloaded from https://sites.google.com/site/biasanalysis/Home

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