SJC-13234

COMMONWEALTH vs. JAMES SOUZA.

Bristol. March 8, 2024. - October 1, 2024.

Present: Budd, C.J., Gaziano, Wendlandt, & Georges, JJ.

Homicide. Felony-Murder Rule. Robbery. Deoxyribonucleic Acid. Evidence, Scientific test, Relevancy and materiality, Expert opinion, Hearsay. Practice, Criminal, Hearsay, Exhibits, Capital case. Witness, Expert.

Indictment found and returned in the Superior Court Department on April 5, 2016.

The case was tried before Thomas F. McGuire, Jr., J.

Stephen Paul Maidman for the defendant.
Shoshana E. Stern, Assistant District Attorney, for the Commonwealth.

GEORGES, J. A jury convicted the defendant, James Souza, of murder in the first degree on a theory of felony-murder, with the predicate offense of armed robbery. In this direct appeal, the defendant contends the trial judge abused his discretion by admitting evidence concerning a type of deoxyribonucleic acid

(DNA) analysis known as Y-chromosome short tandem repeat (Y-STR) testing.[1] The defendant further argues the trial judge erred by admitting in evidence a document, derived from other evidence, that depicted the Commonwealth's proposed timeline of events. Lastly, the defendant contends the Commonwealth presented insufficient evidence for the jury to find he committed the predicate offense, armed robbery. We affirm the defendant's convictions, and after a careful review of the record, we decline to grant relief under G. L. c. 278, § 33E.

Background. 1. Facts. We summarize the facts the jury could have found, reserving some details for later discussion. See Commonwealth v. Acevedo, 492 Mass. 381, 382 (2023).

On March 14, 2016, the victim, Vannessa Courtney, was stabbed to death in her apartment in Taunton. The victim sold drugs from her apartment, where she lived with her young son and her partner. One of her frequent customers was the defendant,

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[1] "Short tandem repeat (STR) testing focuses on different places (loci) on the human genome where certain known sequences of DNA base pairs repeat themselves. The repeat sequences at a particular locus are called alleles. Analysts measure the number of times these repeat sequences occur in a forensic DNA sample to determine whether the sample matches the subject's DNA profile. Y-STR typing is a technique by which analysts separate male DNA from female DNA and focus only on the male fragment." Commonwealth v. DiCicco, 470 Mass. 720, 724 n.11 (2015). See note 16, infra (defining alleles). "Y-STR testing . . . is commonly used in situations . . . where there is a large amount of female DNA and potentially only a small amount of male DNA." Commonwealth v. Bizanowicz, 459 Mass. 400, 406 n.9 (2011).

who purchased drugs from the victim almost daily. When the defendant sought to purchase drugs from the victim, he would send text messages to one of her cell phones[2] -- a "burner phone"[3] the victim used for drug-related transactions with customers. Typically, the victim had the defendant wait in the kitchen of her apartment while she retrieved the drugs from a black metal lockbox in her bedroom, which she stored on the top shelf of the bedroom closet. The defendant often owed the victim money for the drugs he purchased from her; as of the day of the murder, the defendant owed the victim approximately $900.[4]

The night before the murder, the defendant sent a text message to the victim, asking if he could stop by her apartment in the morning. The next morning, the victim's son left for school at 7:40 A.M., and the victim's partner left for work sometime before 9 A.M. The victim, meanwhile, was asleep.

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[2] The victim also owned a second cell phone that she kept for personal use.

[3] A burner phone is "a prepaid cell phone that is not bound to a contract with a carrier . . . and is usually intended to be disposed of after use." Merriam-Webster Online Dictionary, https://www.merriam-webster.com/dictionary/burner%20phone [https://perma.cc/PZH6-YQ6T].

[4] During his police interview, the defendant admitted the victim had allowed him to "run [his] bill up" and pay it back piecemeal. The defendant was hiding his drug use from his fiancée, who controlled his finances, which impeded the defendant's ability to pay the victim.

Later that morning, at 10:19 A.M., the defendant sent the victim another text message asking if she was awake, to which she replied "Yeah" at 10:21 A.M.[5]

According to cell site location information (CSLI) data, between 10:27 and 10:36 A.M, the defendant's phone moved from Fall River to Taunton. The defendant drove a distinctive silver 2002 Mercury Sable with a driver's door that was darker in color compared to the rest of the car's body. As recorded on surveillance video from several different businesses, a vehicle resembling the defendant's Mercury Sable -- with a visibly darker driver's door -- travelled toward, and then turned onto, the victim's street at 10:43 A.M. Between 10:50 and 10:51 A.M., the defendant and the victim exchanged several text messages, with the defendant asking to purchase drugs. The victim's last outgoing text message was at 10:52 A.M. to her partner; no outgoing activity was recorded on the victim's phones after this time, despite numerous attempts by the victim's partner to contact the victim throughout the day via text message and cell phone calls.

At 11:03 A.M., security camera footage recorded an individual dressed in dark clothing walking away from the

[5] Between 10:27 and 10:30 A.M., the defendant made several calls to his grandmother asking for money, which she declined to provide.

victim's residence. Additional security camera footage then recorded a vehicle resembling the defendant's car going down the victim's street, away from her house. According to surveillance footage from a nearby gasoline station, the same car pulled into the gasoline station at 11:15 A.M., and a person got out of the vehicle. Resembling the defendant, the person wore a long-sleeved gray shirt with writing on it -- consistent with the defendant's work uniform -- and kept his hands wrapped in the sleeves of the shirt. He entered the gasoline station bathroom and then left shortly thereafter.

At 11:26 A.M., the defendant sent several text messages to the victim indicating he would come by after work because he had been called into work on the way to the victim's house. The defendant sent additional text message to the victim's phone throughout the day asking if his messages went through, seeking an answer, and indicating he wanted to purchase drugs. At 1:05 P.M. that afternoon, as depicted on surveillance video, a car resembling the defendant's Mercury Sable pulled into the parking area of a large retail store in Fall River. Inside the store, the driver purchased several items, including sneakers. He entered a bathroom, and then walked out wearing the new sneakers. At 2 P.M., the defendant arrived at his workplace, a car detailing company in Fall River, but was not wearing his required work uniform -- a gray shirt with blue lettering.

After trying and failing to reach the victim by phone throughout the day, the victim's partner returned home and found the victim's body in a large pool of blood lying face down on the threshold between the living room and bedroom. Medical examiners later determined the victim had suffered forty-two separate injuries, including stab wounds to her neck, chin, and jaw, cuts to her shoulders, a stab and cut to her abdomen, and thirty or more defensive wounds to her hands, wrists, and forearms. It was also determined that the fatal injury was a seven-inch cut to her neck, which would have caused her to lose consciousness within seconds and die in about a minute.

Upon discovering the body, the victim's partner called 911. When the paramedics arrived at about 6 P.M., the victim's body was cold and stiff, surrounded by "a large pool of what appeared to be coagulating dark blood." Responding officers observed the victim's lockbox, stained with blood on the inside of the lid, was sitting on the bedroom dresser open and empty; both of the victim's cell phones were also missing. Two footwear impressions that did not correspond to any known samples were identified inside the bedroom. There were no signs of forced entry into the apartment. Stains on the inside of the kitchen door tested positive for the presence of blood. There was a trail of similar stains leading from the living room to the front door.

On Tuesday, March 15, the day after the murder, the victim's partner called the defendant and asked if he had seen the victim the previous day. The defendant told her that he had been at the victim's apartment on Monday morning at 7:30 A.M., that he had tried to call her at 10:30 A.M. but she had not been answering, and that he hoped the victim's partner did not think he had "anything to do with it because he had to be at work at 11[A.M.]."

On Wednesday, March 16, Taunton police officers conducted an interview with the defendant.[6] He admitted to purchasing drugs, including a bag of heroin, from the victim at her apartment on the morning of the murder and estimated he was there between 9:30 and 10 A.M. Although the defendant represented he had been wearing the same sneakers at the apartment that he was wearing during the interview, and further indicated that these sneakers had been purchased months prior, one of the officers observed that the sneakers looked new. The defendant also informed the officers that, around midday on the day of the murder, he had gone to a retail store and bank, both

[6] Before trial, the defendant moved to suppress the interview statements he made to the police. Following an evidentiary hearing, the motion was allowed in part. The portions of the interview referenced in this opinion were not suppressed.

in Fall River.[7]

The defendant also told the officers that because his fiancée controlled the money in their joint bank account and knew about his drug habit, he would invent excuses to hide his drug expenditures from her. For example, the prior week, he had generated an estimate for $1,500 worth of parts for his car at an automotive parts retailer and showed the estimate to his fiancée as a purported receipt to get access to money from her with which to purchase drugs.

Later that month, a group of Taunton and State police officers searched a beach in Fall River and recovered a bloodstained black fleece jacket. In the jacket's pockets, they recovered Suboxone, a prescription bottle labeled with the victim's name, a receipt from a Fall River branch of the defendant's bank, and a printout, dated March 7, 2016, approximately one week before the murder, from an automotive parts retailer listing prices for various car parts. Samples of bloodstains on the jacket's sleeves were tested, yielding a female DNA profile consistent with the victim. Additionally, Y-STR testing of the jacket's interior collar and from a bloodstain inside the lid of the victim's lockbox yielded a male DNA profile consistent with the defendant. The expected

[7] The retail store was the same store where the driver had purchased new sneakers.

frequency of the Y-STR profiles derived from the lockbox and the jacket were calculated to be one in 1,355 males and one in 1,337 males, respectively.

Officers also searched the defendant's car and retrieved a receipt from a Fall River branch of the defendant's bank with the last four digits of the account number matching the digits on the bank receipt found in the fleece jacket. Areas of the car tested positive for the presence of nonvisible blood.

2. Procedural history. In April 2016, a Bristol County grand jury indicted the defendant for murder, G. L. c. 265, § 1, and armed robbery, G. L. c. 265, § 17.

Prior to trial, the trial judge allowed the Commonwealth's motion to admit the testimony of a substitute DNA analyst, who was a technical reviewer of the then-departed analyst's work. The defendant filed two motions in limine to exclude the Y-STR DNA evidence, asserting the "DNA Y-STR testing [was] not reliable" and that "any opinion testimony [based on the Y-STR DNA evidence was] speculative and therefore its prejudicial effect outweigh[ed] its probative value." After an evidentiary hearing, the judge denied the defendant's motion to exclude the Y-STR DNA evidence but allowed the defendant to call an expert witness to testify why, in his view, the statistics proffered by the Commonwealth were misleading.

The trial began on October 10, 2018. At the close of the

Commonwealth's case, the defendant orally moved for a required finding of not guilty, which was denied. On October 30, 2018, the jury found the defendant guilty of murder in the first degree on a theory of felony-murder with armed robbery as the predicate felony.[8] The defendant was sentenced to life in prison without the possibility of parole. The defendant timely appealed.

Discussion. Where we consider a defendant's direct appeal from a conviction of murder in the first degree, we review the entire case in accordance with G. L. c. 278, § 33E. See Commonwealth v. Billingslea, 484 Mass. 606, 617 (2020). "We therefore review raised or preserved issues according to their constitutional or common-law standard and analyze any unraised, unpreserved, or unargued errors, and other errors we discover after a comprehensive review of the entire record, for a substantial likelihood of a miscarriage of justice." Commonwealth v. Upton, 484 Mass. 155, 160 (2020).[9]

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[8] The jury also separately found the defendant guilty of armed robbery. The judge sentenced the defendant to concurrent life sentences in State prison for both convictions. The armed robbery conviction was subsequently vacated. See Commonwealth v. Tyler, 493 Mass. 752, 757 n.4 (2024).

[9] For several of the issues he raises on appeal, the defendant couches his arguments in both constitutional and nonconstitutional terms. Because these issues, largely concerning alleged errors in the admission of evidence, can be resolved on nonconstitutional grounds, we need not examine them through a constitutional lens. See Commonwealth v. Bartlett,

1. Y-STR evidence. The defendant challenges the admission of the Y-STR DNA testing results performed on samples from the interior top of the lockbox and the interior collar of the black jacket and any opinions of the Commonwealth's experts derived from those results. Specifically, the defendant argues that this evidence was unfairly prejudicial, or outright irrelevant, because it was "based on an unrepresentative Y-STR database" that failed to account for the fact that a disproportionate concentration of men in southeastern Massachusetts -- i.e., men with the same paternal lineage as the defendant -- share his Y-STR profile. Without accounting for this "distinct population substructure"[10] in southeastern Massachusetts, the defendant asserts, the expected frequency of the Y-STR profiles -- that

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374 Mass. 744, 749 (1978) ("if a case can be decided on either of two grounds, one involving a constitutional question, the other a question of statutory construction or general law, the [c]ourt will decide only the latter" [citation omitted]). See also Commonwealth v. Santos, 460 Mass. 128, 137 (2011) ("Ordinarily, an error in the admission or exclusion of evidence is not of constitutional import" [citation omitted]).

[10] The theory of population substructure "states that there are significant genetic subgroups within larger heterogeneous populations such as the Caucasian or Black population. These subgroups most likely occur along racial and ethnic lines and present significant pockets of genetic variation within the larger population group. Population substructure, therefore, presents the possibility that using allele frequencies of larger population groups might produce an inaccurate frequency estimate for members of substructure groups." (Citations omitted.) Commonwealth v. Lanigan, 413 Mass. 154, 160-161 (1992), S.C., 419 Mass. 15 (1994).

is, approximately one in 1,300 males -- could have been "overstate[d]" at trial. This overstated frequency evidence could be compounded, he further contends, by widespread beliefs about the general potency of DNA testing. Accordingly, the jury likely gave undue weight to the probative value of the Y-STR testing results as conclusively connecting the defendant to the tested samples.

The Commonwealth responds that the DNA evidence was properly admitted because the Y-STR testing adhered to "nationally recognized professional standards" established by the Federal Bureau of Investigation's scientific working group on DNA analysis methods. The Commonwealth further notes that the defense extensively cross-examined its expert on the limitations of the statistical frequencies and that the judge properly instructed the jury on how to interpret DNA evidence -- emphasizing the differences between autosomal STR testing, discussed infra, and Y-STR testing. In the Commonwealth's view, the expert testimony on the limitations of Y-STR testing, along with the jury instructions, provided sufficient context for the jury to properly consider the DNA evidence.

a. Standard of review. We first address the defendant's arguments that the Y-STR DNA evidence was unfairly prejudicial. Evidence is relevant if it has a "rational tendency to prove an issue in the case," or sheds light on an issue (citation

omitted). Commonwealth v. Yat Fung Ng, 491 Mass. 247, 264 (2023). See Commonwealth v. Vitello, 376 Mass. 426, 440 (1978). See also Mass. G. Evid. § 401 (2024) ("Evidence is relevant if [a] it has any tendency to make a fact more or less probable than it would be without the evidence and [b] the fact is of consequence in determining the action"). Even when relevant, evidence may be excluded if its probative value is substantially outweighed by the danger of unfair prejudice. See Commonwealth v. Spencer, 465 Mass. 32, 48 (2013). See also Mass. G. Evid. § 403. "We review a judge's decision whether the probative value of evidence is substantially outweighed by the danger of unfair prejudice under the abuse of discretion standard" (citation omitted). Yat Fung Ng, supra. In doing so, we evaluate whether "the judge made a clear error of judgment in weighing the factors relevant to the decision, such that the decision falls outside the range of reasonable alternatives" (quotation and citation omitted). L.L. v. Commonwealth, 470 Mass. 169, 185 n.27 (2014). "[T]he admissibility of DNA test results should be determined on a case-by-case basis" (citation omitted). Commonwealth v. DiCicco, 470 Mass. 720, 729-730 (2015).

b. Evidence at trial on Y-STR testing. At trial, Elizabeth Duval, a forensic scientist in the DNA unit at the State police crime laboratory (State crime lab or lab),

testified that the State crime lab performs two types of tests: autosomal STR testing[11] and Y-STR testing. Y-STR testing -- a type of STR analysis that focuses on the Y-chromosome -- is a male-specific test, useful for focusing on the male portion of a DNA sample mixed with a large amount of female DNA. However, Duval acknowledged Y-STR testing provides far less precise results than autosomal STR testing, in part because all males in a paternal line share the same Y-STR profile.

The difference in precision between the two types of DNA testing was highlighted by the statistical evidence that accompanied the testing performed in this case. Duval testified that, when she conducted autosomal STR testing on the bloodstain from the inside lid of the lockbox, she obtained a single-source DNA profile consistent with the victim, with a corresponding frequency of one in 36.83 quintillion unrelated persons. She then conducted Y-STR testing on the same bloodstain from the lockbox. The defendant's profile was consistent with the male profile.[12] The expected frequency of the Y-STR profile from the

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[11] Autosomal STR testing refers to a method of DNA testing that involves examining non-sex chromosomes or, in other words, chromosomes other than X and Y chromosomes. See United States vs. Russell, U.S. Dist. Ct., No. CR-14-2563 MCA, slip op. at 7 & n.2 (D.N.M. Jan. 10, 2018).

[12] The sample obtained from the bloodstain that was used for Y-STR testing was determined to be a mixture of at least two male contributors with a major male profile. The major male profile was consistent with the defendant's profile.

lockbox, however, was one in 1,355 males, or an expected exclusion of 99.92 percent of the population.

Duval went on to describe the "count" method used to arrive at the expected frequency statistics, and the ninety-five percent "confidence interval" that was used to account for representative limitations in the national database against which the Y-STR profiles were tested. Regarding the count method, she explained that the lab puts a Y-STR profile obtained from a piece of evidence into a national database. From there, a "direct search or count" is generated as to "how many times that [Y-STR] profile has been seen" in any of four different populations represented in the database -- African-American, Caucasian, Asian, and Hispanic. See Commonwealth v. Lally, 473 Mass. 693, 701 (2016) ("'counting method' . . . describes the frequency in which a DNA match is found in a given database").

With respect to the "confidence interval," Duval went on to explain that, because the database has a limited number of profiles, the lab applies "a mathematical equation that's accepted in scientific field[s], called a confidence interval." As for the ninety-five percent confidence interval, she explained that this confidence interval "let[s] us know that [for] the [expected] frequency that we are generating, . . . we're [ninety-five] percent sure that the actual real frequency that exists for that profile in that population is the correct

one." In other words, the confidence interval "adjusts the frequency to make it more applicable, if in fact, all the profiles were representative in the database." See Lally, 473 Mass. at 701 ("A 'confidence interval' adjusts . . . result[s] to account for sampling errors and identical profiles being passed through a paternal line, and thus increases the likelihood that the same profile could be found in a population").

However, if, as in this case, a profile is not in the database, a slightly different mathematical equation is applied: the lab accounts for all the profiles that may be missing and applies the ninety-five percent confidence interval. After generating frequencies for the four aforementioned populations, the lab reports whichever result is least rare, regardless of which population gave that result.

Another employee from the State crime lab's DNA unit, Kira Snyder, testified that the Y-STR profile from the jacket had an expected frequency of occurrence of one in 1,337 males, excluding 99.92 percent of the population. In her calculation, Snyder applied the ninety-five percent confidence interval.

The defense's expert witness, Steven Laken, did not dispute the Commonwealth's calculation of "the frequency of the Y-STR in

the [United States] population."[13] Nor did he dispute that the profile belonged to either the defendant or one of his male relatives. Rather, in Laken's opinion, the reported frequency from the national Y-STR database, even though accurately calculated, was "meaningless," as the "relevant population[s]" could be Massachusetts or Fall River, but not the United States in its entirety. Laken reasoned that because of geographically unequal distributions of populations with particular ethnic backgrounds and the geographic concentration of some families, localized frequencies of a particular Y-STR profile may exceed national frequencies.

In this case, Laken testified that approximately eighteen living male relatives in the defendant's male lineage share the same Y-chromosome and thus would have the same Y-STR profile. He further testified that the defendant's family emigrated from Portugal, and many of his male relatives stayed in a relatively small geographic location within Massachusetts, meaning that the frequency of their Y-chromosome would be different in Massachusetts than it would be across the United States. Thus, the crux of Laken's testimony was that the Commonwealth's use of the national Y-STR database was misleading and inappropriate.

[13] Laken also testified that, to his knowledge, there was no Massachusetts-specific Y-STR database.

c. Analysis. As noted above, the defendant claims the trial judge erred in admitting the Y-STR evidence because it was unduly prejudicial. Before we consider the propriety of the trial judge's admission of the Y-STR evidence, however, a brief discussion of Y-STR testing in general is warranted.

Y-STR analysis is "commonly used in situations such as that here, where there is a large amount of female DNA and potentially only a small amount of male DNA" (citation omitted). Commonwealth v. Evans, 469 Mass. 834, 841 n.13 (2014). "Because Y-STR testing is limited to the Y-chromosome, and men in the same paternal line each have the same Y-chromosome, Y-STR testing cannot discriminate among members of the same paternal line." Id. Accordingly, our case law requires nonexclusion DNA evidence,[14] including Y-STR evidence, to be presented with "reliable accompanying evidence as to the likelihood that the test could not exclude other individuals in a given population," so that the jury have sufficient context to "evaluate the meaning of the result" (citation omitted). Lally, 473 Mass. at 704.

[14] Unlike DNA "match" evidence, nonexclusion DNA evidence indicates that a person cannot be excluded as a possible source of the DNA found at a crime scene. See Commonwealth v. Tassone, 468 Mass. 391, 394 (2014) (discussing DNA matches); Commonwealth v. Mattei, 455 Mass. 840, 852-853 (2010) (discussing nonexclusion DNA evidence).

Providing this context to the jury is necessary to counteract the "generally well known [belief] that DNA testing often allows scientists to identify a particular individual from among millions," because while that may be true for autosomal STR testing, it is not necessarily true for Y-STR testing (citation omitted). See Commonwealth v. Mattei, 455 Mass. 840, 852 (2010). As we have previously explained, even DNA match results are "of little or no value without reliable evidence indicating the significance" (citation omitted). Id. at 850-851. Moreover, "nonexclusion evidence presented without statistics could be even more prejudicial than match evidence because jurors could be misled into thinking that nonexclusion results are as significant as the large numbers typically applicable to match results." Lally, 473 Mass. at 703.

Here, the Y-STR test results were presented to the jury with sufficient context for the jury to meaningfully evaluate the statistical results. Duval testified that, with respect to the Y-STR profile from the swab of the interior top of the lockbox, the expected frequency of this profile was approximately one in 1,355 males. Based on this result, she concluded that she would not expect to see this profile in 99.92 percent of the population. Snyder then testified that the Y-STR profile obtained from the interior collar of the black jacket was consistent with the defendant's profile, with an expected

frequency of one in 1,337 males -- or an expected exclusion of 99.92 percent of the population. Additionally, the witnesses supplied the jury with an explanation of the ninety-five percent confidence interval. See Lally, 473 Mass. at 704-705 ("Although guidelines now suggest the use of a confidence interval to make the statistics from the counting method more conservative, . . . the counting method . . . provided sufficient context for the results"). Thus, both expert witnesses adequately contextualized the nonexclusion DNA evidence with statistics explaining their significance. See id. See also State v. Tucker, 301 Neb. 856, 867 (2018) (Y-STR DNA test results admissible where "accompanied by the required statistical context"). The expected frequencies of the Y-STR profiles were in stark contrast to the population frequency associated with the autosomal STR profile from the lockbox -- i.e., one in 36.83 quintillion. This information further minimized any potential prejudice that could stem from the jury's misunderstanding about the expected frequencies associated with the Y-STR tests. See Lally, supra at 705.

The Y-STR evidence was clearly relevant. It tended to show that the defendant was the killer since he could not be excluded from the class of men who could have left DNA evidence on the jacket and lockbox. Although the Y-STR testing could not determine that the defendant was the definitive source of the

DNA evidence, this did not render the test results irrelevant or unfairly prejudicial. See State v. Jones, 2015 UT 19, ¶ 30 ("The fact that Y-STR DNA evidence is less powerful than other forms of DNA evidence does not automatically render it unfairly prejudicial . . .").

The defendant had the burden of establishing that the probative value of the Y-STR testing results was substantially outweighed by the danger of unfair prejudice, and he carries the burden of establishing an abuse of discretion on appeal. See Commonwealth v. Carter, 475 Mass. 512, 519 & n.12 (2016); Commonwealth v. Gray, 463 Mass. 731, 752 (2012) ("The defendant bears the burden of establishing both an abuse of discretion and the resulting prejudice"). To this end, the defendant claims that the Y-STR evidence was unduly prejudicial because "[t]he [d]efendant's ethnic heritage necessarily created a distinct non-random population substructure in [s]outheastern Massachusetts affecting the reported expected frequency of the Y-STR profile."

However, beyond speculation about family members in the surrounding area, the defendant has not pointed to any evidence indicating that his Portuguese heritage makes it particularly likely that his haplotype[15] would be disproportionately

[15] "The DNA segments that are the focus of Y[-]STR testing are inherited as a block through an individual's paternal

represented in the Y-STR test results. Further, the Commonwealth's experts addressed the regional variations in the expected frequency of the Y-STR profile. Duval explained that, in calculating the confidence interval, the State crime lab applied scientific standards designed to account and compensate for limitations in the national database. She testified that the database did not have to be limited to southeastern Massachusetts because

> "there are maybe groups or individuals that are not accounted for in that database, which we already know. So when we develop the profile probability, which is that frequency that tells us how often you would expect to see that particular profile, we also in conjunction use a mathematical formula, which is called the confidence [interval] rule, which allows us to know that we are going to adjust that frequency based upon the fact that the sample size is limited, the database is limited in size and not everybody's profile is in it. So it's accounting for the fact that there may not be profiles in there that are representatives of a particular area."

Duval also testified that the national Y-STR database includes samples from every geographical area of the country.

The defendant is entitled to relief only if he can demonstrate that the trial judge's decision to admit the Y-STR evidence was an abuse of discretion; that is, if the decision "falls outside the range of reasonable alternatives." L.L., 470

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lineage. This block is known as a 'haplotype' -- 'a set of closely linked genetic markers present on one chromosome which tend to be inherited together'" (citation omitted). State v. Bander, 150 Wash. App. 690, 700 (2009).

Mass. at 185 n.27. The defendant has not made such a showing. Accordingly, the trial judge did not err in admitting the Y-STR evidence. See Yat Fung Ng, 491 Mass. at 266.

2. Substitute analyst. Relying on Commonwealth v. Chappell, 473 Mass. 191, 202 (2015), the defendant next argues that the direct examination testimony of Snyder, the Commonwealth's substitute DNA expert, regarding the expected frequency of the Y-STR profile from the black fleece jacket was inadmissible hearsay. The defendant contends the substitute analyst could not testify to the expected frequencies because she did not herself conduct the calculations; rather, she merely reviewed the numbers generated by the original analyst. This, the defendant argues, contravened the rule prohibiting a substitute expert from testifying on direct examination to facts or data underlying her opinion when those facts or data were generated by a second, nontestifying expert. See id. This argument fails.

We review a judge's determination of whether evidence constituted inadmissible hearsay for an abuse of discretion. Yat Fung Ng, 491 Mass. at 257. On direct examination, an expert may not testify to facts underlying her opinion where they are the "fact[s] of the test results obtained by someone else [because such testimony is] hearsay" (citation omitted). Commonwealth v. Greineder, 464 Mass. 580, 583, cert. denied, 571

U.S. 865 (2013). Stated differently, "an expert witness is not permitted to testify on direct examination to facts or data that another, nontestifying expert has generated, . . . even though this information may be an important part of the basis of the testifying expert's opinion." Chappell, 473 Mass. at 202.

Despite this limitation, computer-generated results that calculate the statistical probabilities of DNA profiles are not hearsay. That is because "[c]omputer-generated records are created solely by the mechanical operation of a computer and do not require human participation" -- i.e., they do not contain a statement from a person. Commonwealth v. Davis, 487 Mass. 448, 465 (2021), S.C., 491 Mass. 1011 (2023). See Commonwealth v. Thissell, 457 Mass. 191, 197 n.13 (2010). See also Mass. G. Evid. § 801(a) ("'Statement' means a person's oral assertion, written assertion, or nonverbal conduct, if the person intended it as an assertion"). Thus, rather than implicating hearsay concerns, computer-generated records instead raise concerns about "authentication of the generative process that created the records." Thissell, supra.

Here, the substitute analyst's testimony was not hearsay. At trial, Snyder -- the substitute expert -- testified to the expected frequency of the DNA profile from the fleece jacket. Snyder had been the technical reviewer for the analyst who had originally analyzed the fleece jacket DNA. As a technical

reviewer, Snyder reviewed the worksheets documenting the original analyst's testing, the data she generated, and the report she wrote summarizing the results. Using a calculator, Snyder duplicated the original analyst's calculation regarding the percentage of the population excluded by the Y-STR profile. Snyder also confirmed that the original analyst had correctly entered the data into the Y-STR program but did not duplicate running the particular alleles[16] through the Y-STR database. Rerunning the alleles through the Y-STR database, Snyder stated,

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[16] "A single DNA molecule contains approximately three billion rungs, or base pairs. Certain types of human genes that are called 'polymorphic' can occur in alternate forms (that is, with differing sequences of base pairs), each of which is capable of occupying a gene's position on the DNA ladder. These alternate forms of genes are called 'alleles,' and are highly variable from one person to another. Alleles of a particular gene contain a different number of base pairs, and therefore are of different lengths.

"Most of the sequences of base pairs in all human DNA molecules are identical. However, roughly three million base pairs are alleles that vary in sequence among humans. The areas on the DNA ladder in which the DNA sequence varies are called 'polymorphic sites.' Some such sites are more polymorphic than others. Forensic DNA testing makes use of sites which are 'highly polymorphic.'

"If all three million base pairs which vary among humans could be examined and compared, DNA analysis could be completely individualized. However, due to the scope of such an undertaking, forensic DNA testing is limited to the examination and comparison of the length of several highly polymorphic alleles."

Commonwealth v. Curnin, 409 Mass. 218, 228 (1991) (Appendix).

would have entailed selecting a "drop-down menu," putting in the "number that was part of the item of evidence and then basically hit[ting] calculate."

The underlying data introduced by Snyder was the computer-generated results analyzing the alleles, rather than the alleles themselves. Because this data is the product of a computer-generated report, Snyder was entitled to disclose the results of that report on direct examination. The judge did not abuse his discretion by admitting the substitute analyst's testimony regarding the expected frequency of the Y-STR DNA profile.[17]

3. Compilation exhibit. The defendant challenges the Commonwealth's presentation to the jury and evidentiary admission of a compilation exhibit. This exhibit was a disk containing a digital file, created by a police witness, that compiled seventy images derived from portions of previously admitted exhibits, including maps of cell phone towers, still images from surveillance videos, and photographs. At the time

[17] With respect to the defendant's confrontation rights, substitute DNA analysts are allowed to testify to their opinions based on the test results conducted by another analyst, so long as the defendant is able to cross-examine the substitute analyst in a meaningful way regarding possible flaws in the data underlying the basis of the opinion. See Chappell, 473 Mass. at 201. In this case, the defendant was afforded and, in fact, took full advantage of the opportunity to cross-examine Snyder on the data at issue. Accordingly, the defendant cannot claim a violation of his confrontation rights.

the exhibit was introduced, it was accompanied by the testimony of the police witness, who described the content of the disk and provided an overview of the timeline of the case. As the defendant timely objected, we consider whether admission of the exhibit resulted in prejudice to the defendant. Davis, 487 Mass. at 465.[18]

Even assuming the judge abused his discretion in admitting this exhibit, we conclude the defendant was not prejudiced. It is undisputed that all of the component parts of the compilation exhibit were previously introduced in evidence. Regardless of whether this particular exhibit was introduced in evidence, we

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[18] We review a decision to admit such a summary in evidence for abuse of discretion. See Commonwealth v. Souza, 492 Mass. 615, 626 (2023). The defendant argues that the compilation exhibit served only as a "pre-closing argument" to suggest certain "inferences and conclusions" to the jury, but he does not identify any specific inaccuracies in the compilation or make any specific claims that it was not neutral. Vague, conclusory arguments fall short of demonstrating that the judge abused his discretion in admitting evidence. See L.L., 470 Mass. at 185 n.27 (to establish abuse of discretion, defendant must show there was "a clear error of judgment in weighing the factors relevant to the decision such that the decision falls outside of the range of reasonable alternatives" [quotation and citation omitted]). In any event, the compilation exhibit accurately reflected a summary of records previously admitted in evidence, and the judge did not abuse his discretion in admitting it in evidence or allowing the Commonwealth to present it to the jury. See Commonwealth v. Carnes, 457 Mass. 812, 825 (2010) ("Summaries of testimony are admissible, provided that the underlying records have been admitted in evidence and that the summaries accurately reflect the records"); Commonwealth v. Greenberg, 339 Mass. 557, 581-582 (1959). See also Mass. G. Evid. § 1006.

are sure the compilation exhibit "did not influence the jury, or had but very slight effect" (citation omitted). Commonwealth v. Sosa, 493 Mass. 104, 114 (2023), petition for cert. filed, U.S. Supreme Ct., No. 24-5111 (July 18, 2024). See id. at 115 ("sequencing of certain events from the longer video footage into the compilation video" was not prejudicial); Commonwealth v. Wood, 90 Mass. App. Ct. 271, 282 (2016) ("Where all of the material in [the compilation exhibit] was previously admitted in evidence and the limited duplication, sequencing, and highlighting of the exhibits by the Commonwealth added little to the Commonwealth's case . . . we conclude that . . . [the compilation exhibit] exerted little or no effect on the outcome"). Substantial other evidence linked the defendant to the crime, including surveillance video footage, CSLI data and phone records, the defendant's own admissions and inconsistent statements, as well as the receipts from the automotive parts retailer and the defendant's bank. Under these circumstances, the defendant suffered no prejudice.

4. Armed robbery. The defendant argues there was insufficient evidence he committed an armed robbery -- the predicate offense for his felony-murder conviction. In particular, the defendant argues that just because the victim's cell phones were missing does not demonstrate beyond a reasonable doubt that he took them. Further, according to the

defendant, even assuming the jury believed the evidence linking him to the jacket, the evidence suggests that the pill bottle found in the jacket pocket was used by the victim to distribute drugs to the defendant -- i.e., the defendant acquired the bottle through a routine transaction with no intent to steal it. We disagree.

"In evaluating the sufficiency of the evidence supporting a conviction, we determine whether, viewing the evidence in the light most favorable to the Commonwealth, any rational finder of fact could have found each of the elements of the offense beyond a reasonable doubt" (quotation and citation omitted). Commonwealth v. Gonsalves, 488 Mass. 827, 834 (2022). The elements of armed robbery are that the defendant "(1) was armed with a dangerous weapon; (2) either applied actual force or violence to the body of the person identified in the indictment, or by words or gestures put [that person] in fear; (3) took the money or the property of another; and (4) did so with the intent (or sharing the intent) to steal it" (quotation and citation omitted). Commonwealth v. Duke, 489 Mass. 649, 658 (2022).

Here, the jury were entitled to conclude from the evidence that the person who murdered the victim took the pill bottle and her cell phones with the intent of stealing these items. The victim had been exchanging text messages with her partner and with the defendant just prior to her death. Further, an

investigating officer testified that neither cell phone was recovered in the course of the investigation. See Commonwealth v. Martin, 467 Mass. 291, 314 (2014) ("Given statements from law enforcement officials and the victim's uncle indicating that none of these items was recovered, the jury were permitted to conclude that they were absent due to a robbery"). Accordingly, the jury reasonably could infer that both cell phones were in the victim's possession when she was killed and were stolen before her body was discovered. Moreover, in light of the evidence surrounding the victim's murder, including the bloodstains on the inside of the lockbox where she stored her drugs, the defendant's theory concerning the pill bottle simply "ignore[s] that, under the Latimore standard, we are to view the evidence in a light most favorable to the prosecution." Commonwealth v. Sylvia, 456 Mass. 182, 191 (2010), citing Commonwealth v. Latimore, 378 Mass. 671, 677 (1979). Accordingly, the jury were entitled to conclude that an armed robbery occurred.

5. Review under G. L. c. 278, § 33E. Having reviewed the entire record pursuant to G. L. c. 278, § 33E, we discern no reason to reduce the conviction of murder in the first degree to a lesser degree of guilt or order a new trial.

Judgment affirmed.